

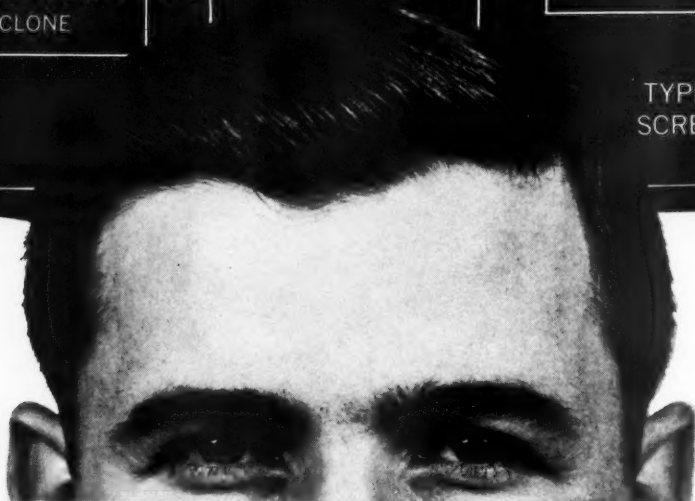
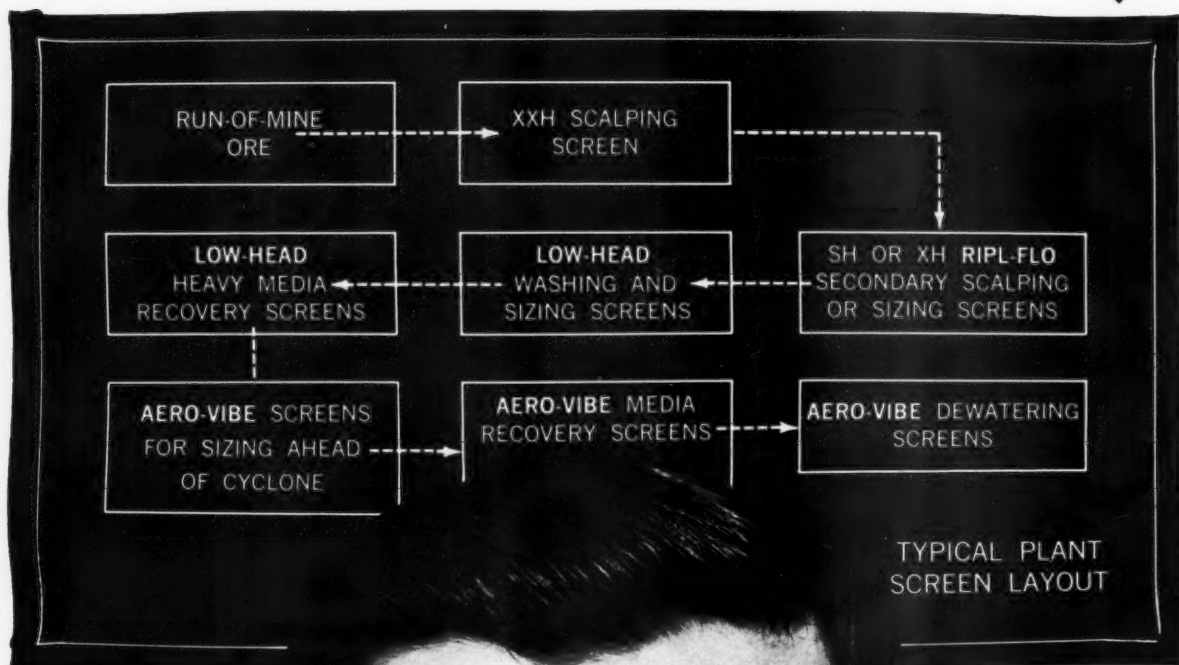
MINING JOURNAL



COAL SHOW

Preview

ALLIS-CHALMERS



Analyze your plant flow, screen by screen: How much are your screens costing you?

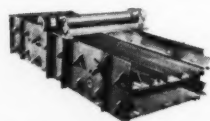
Short cuts in cost can only lead to trouble. There's no "safe" spot where you can economize on equipment. And this certainly applies to screens. They're an important part of the day-in, day-out dependability you have to have throughout your system.

All of your screening operations — scalping, sizing, washing, dewatering, media recovery — carry full responsibility for continuous, uninterrupted flow. To live up to this responsibility, your system needs screens

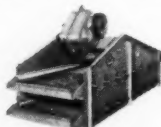
that are engineered to do each specific job. A-C engineering has done just that — with a complete line of screens that assure you top performance under the most rugged conditions.

Ask your A-C representative about the specific features that make A-C screens a dependable part of your system. Or write **Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.** A-1370

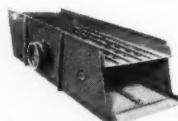
Aero-Vibe, Low-Head and Ripl-Flo are Allis-Chalmers trademarks.



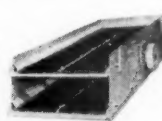
For media drain and dewatering in cyclone plants — AVS Aero-Vibe inclined screen.



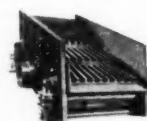
Coarse to fine sizing (wet or dry), rinsing, washing, dewatering and media recovery — Low-Head horizontal screen saves headroom too.



For scalping and coarse sizing, wet or dry — XH Ripl-Flo rugged cost saving inclined screen.



For light scalping, coarse or fine sizing (wet or dry) rinsing or washing — SH Ripl-Flo inclined screen.



For tough primary scalping jobs and high tonnage — XXH ROM inclined screen.



MINING CONGRESS JOURNAL

VOL. 47

APRIL 1961

NO. 4

EDITORIAL DIRECTOR

Julian D. Conover

EDITOR

Robert W. Van Evert

MANAGING EDITOR

George W. Sall

ASSISTANT EDITORS

Glenn F. Jackson

David W. Pinkard

ASSOCIATE EDITORS

Harry L. Moffett

Henry I. Dworshak

Brice O'Brien

Laurence P. Sherfy

Donald S. Whyte

PRODUCTION

Jack Ernest Goodman

ADVERTISING

Patrick D. McMurrer
Manager

Martin C. Dwyer
Assistant Manager

Frank W. Moran
Chicago

Ralph F. Duysters
New York City

Harker-Husted-Coughlin
San Francisco
and Los Angeles

CIRCULATION

M. D. Taylor



Member
Audit Bureau of Circulation

Indexed regularly by Engineering Index, Inc.

Copyright 1961 by

THE AMERICAN MINING CONGRESS
Ring Bldg., Washington 6, D. C.

Raymond E. Salvati

President

Andrew Fletcher

Herbert C. Jackson

Clyde E. Weed

Vice Presidents

Julian D. Conover

Executive Vice President
and Secretary

CONTENTS

Opinions expressed by the authors within these pages are their own and do not necessarily represent those of the American Mining Congress.

ARTICLES

- | | |
|---|----|
| Preliminary Engineering and Water Control at Caland | 34 |
| Peter P. Ribotto | |
| Conventional Mining of a 28 to 36-in. Seam | 39 |
| Clyde H. Storey | |
| New Mill and Surface Plant of the Lucky Friday Mine | 46 |
| J. G. Craig | |
| Crown Vetch as an Aid to Strip Mine Reclamation | 70 |
| C. H. J. Breeding | |
| Underground Ammonium Nitrate Blasting | 72 |
| Adolph V. Mitterer and Ben T. Phillips, Jr. | |
| Silicon Rectifiers | 76 |
| C. L. Sarff | |
| Radiation Control in Uranium Mines and Mills | 77 |
| R. G. Beverly | |
| Maintenance Costs Reduced by Redesign of Fine Coal Cleaning Plant | 84 |
| David G. Werner | |
| Economics of Large Tires for Earthmoving Equipment | 85 |
| C. E. Danby | |

SPECIAL SECTION

- | | |
|--|-------|
| Preview of AMC 1961 Coal Show at Cleveland | 50-69 |
|--|-------|

DEPARTMENTS

- | | |
|----------------------|-----|
| Editorials | 33 |
| Operators' Corner | 90 |
| Wheels of Government | 93 |
| Personals | 97 |
| News and Views | 100 |
| Manufacturers Forum | 113 |

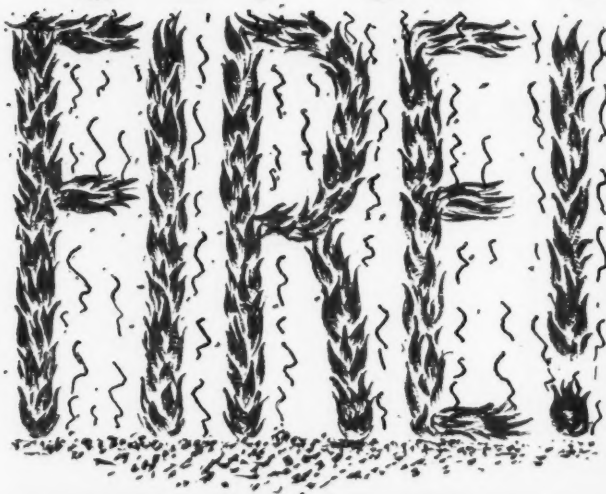
ON OUR COVER

To meet the intense competition in the energy field, the coal mining industry must take full advantage of new operating techniques and equipment that will promote efficiency, safety and quality. An efficient way for mining men to get up-to-date on what is really new is to attend the 1961 AMC Coal Show. This outstanding "refresher course" in modern coal mining technology provides a fertile field for ideas on how to do a better job back at the mine. For full details, see pages 50 to 69.

Published Monthly. Yearly subscriptions, United States, Canada, Central and South America, \$3.00. Foreign, \$10.00. Single copies, \$0.75. February Annual Review Issue, \$1.25. Second class postage paid at Washington, D. C., and at additional Post Office, Lancaster, Pennsylvania.



OUT OF CONTROL



WILL YOUR MINE BE NEXT?

Every year hundreds of thousands of dollars are lost in out of control mine fires — lives are endangered, equipment destroyed, production halted for months and sometimes forever.

With the best of safety equipment — the best trained men — fires *still* go out of control.

What happens then?

What would you do?

Shut down and seal for months or years?

Flood with water, pump out and face the terrible cost of down time and recovery?

Seal a large part of your mine, lose the equipment and stand the expense of constant seal checking?

Or would you — *can you* — fight back?

Today — right now — the magic of high expansion Hi-Ex Foam can be installed in your mine as your fast, safe, second line of defense. *When fire cannot be reached by any other means, Hi-Ex can still stop it in its tracks.* This simple, dependable equipment and the training to make it effective is available today. *Don't let your mine be without it!*

- Fight fire from over 2000 feet away.
- Wet, cool and smother the flaming area.
- Drop temperature and seal off gases.
- Reach trapped men safely through foam without equipment.
- Eliminate forever the fire that's "Too hot to handle".



FOR FULL INFORMATION, WRITE OR CALL:

J. H. FLETCHER & CO.
707 W. 7th St. • P. O. Box 2143
HUNTINGTON, W. VA.
JAckson 5-7811

HI-EX MINE FOAM CAN PROTECT YOU

featured

IN THIS ISSUE—and the

PRELIMINARY ENGINEERING AND WATER CONTROL AT CALAND

To prevent inflow of run-off water from a 25-sq mi catchment area into the mining area, Caland has spent about \$4,000,000 on the construction of some 15 dams and related facilities at its Steep Rock Lake, Ont., iron ore property. The volume of material in these dams is about 1,750,000 cu yd. Auxiliary to the dams are six rock tunnels totaling over 4000 ft in length. Where gravity diversion was not feasible, pumps with a combined capacity in excess of 100,000 gpm were installed.

CONVENTIONAL MINING OF A 28 TO 36-IN. SEAM

Through advanced mining techniques, time study analysis and equipment development, a progressive company in Kentucky has been able to show an increased productivity each year for the past nine years. Here is an interesting picture of a thin-seam operation that points out some of the little-realized problems that are unique to conventional mining in low coal. Emphasis is on the ways and means employed to achieve a productivity better than the national average for underground mines.

NEW MILL AND SURFACE PLANT OF THE LUCKY FRIDAY MINE

Careful planning, good reconditioned equipment, a hard working crew, simple design and flowsheet—these are among the things that enabled Lucky Friday Silver-Lead Mines Co. to hold costs to a minimum in building a modern and efficient mill in record time. Interesting features include stave type ore bins, a remotely operated conveyor incorporating closed circuit TV, automatic feed controls, and hydrocyclone classification.

CROWN VETCH AS AN AID TO STRIP MINE RECLAMATION

Wanted! A plant that will establish itself in one season, form a protective cover, yield a merchantable crop, rebuild the soil, and look pretty. Everyone directly responsible for the reclamation of strip mine lands has been searching for such a plant. Whether it will be found is questionable, but the search goes on. This article covers crown vetch; while it does not meet all of these requirements, it meets many of them. The discussion is centered around site requirements, sowing practices and utilization.

UNDERGROUND AMMONIUM NITRATE BLASTING

Early in 1958, International Minerals & Chemical Corp. set off 13 detonations to determine the feasibility

(CONTINUED ON PAGE 5)

AUTHORS

Peter B. Ribotto has been vice president of Caland Ore Co., Ltd. since 1960. Previously he was manager at Caland's Atikokan, Ont., operations having been promoted to that post from chief engineer of the Iron Mining Department of Inland Steel Co. in 1959. He joined Inland as a mining engineer in 1940 after one year with Phelps Dodge Corp. at Bisbee, Ariz.



Clyde H. Storey's early experience was with the engineering department of the Lynch Division, U. S. Steel Corp., and as a section foreman with U. S. Gypsum Co. In April 1959 he joined Princess Elkhorn Coal Division of Princess Coals, Inc., as assistant to the director of Industrial Engineering and ten months later was promoted to director.

J. G. Craig is general mill superintendent of Hecla Mining Co. He came to Hecla in 1959 from Bunker Hill Co. where he was employed for three years as assistant mill superintendent. From 1940 to 1956, Craig was with New Jersey Zinc Co. at Gilman, Colo., first as mine engineer and later transferring to the Gilman mill where he rose to mill superintendent.



Charles H. J. Breeding received a B.S. degree in Agriculture from the University of New Hampshire in June 1949. Experience includes several years with the Soil Conservation Service of the U. S. Department of Agriculture. Since March 1952 he has been field director of the Ohio Reclamation Association.

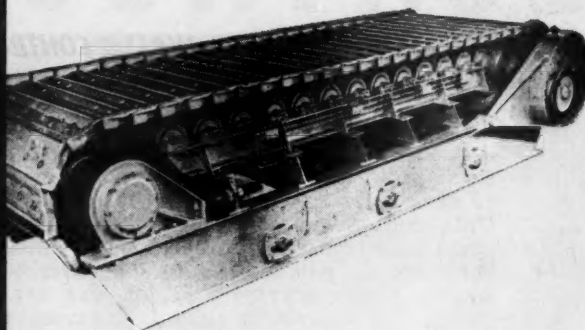
Adolph V. Mitterer became manager of California Salt Co. in November 1960. Before that he was a mining engineer for International Minerals & Chemical Corp. directing the ammonium nitrate development program. Under Mitterer, Ben T. Phillips, Jr., mine project engineer, was in charge of the program. Mitterer was with IMC for six years coming from Colorado School of Mines Re-

**Build
Profits**
with

NICO

MATERIAL CONVEYING EQUIPMENT

The only basic design
changes in feeders in
the past generation.



NICO

Apron Feeders

NICO

Apron Conveyors

NICO

Bucket Conveyors

NICO

Bucket Elevators

NICO

Reciprocating Feeders

NICO

Hydrastroke Feeders

NICO

Hi-Torque Reducers

**Learn the benefits
of Modern Design . . .**

Engineering Catalog 60-A tells the complete NICO Conveying story. Photos, detailed drawings, diagrams, together with engineering data and specifications make it an invaluable reference in determining the right feeder or conveyor. Ask your NICO representative or write direct for your copy.

NICO

NATIONAL IRON COMPANY

50th Avenue West and Ramsey Street

Duluth 7, Minnesota

Subsidiary of Pettibone Mulliken Corporation, Chicago 51, Illinois

ity of using ammonium nitrate in small diameter blastholes. Because of the favorable results—and the potential for reducing costs—the company developed a machine for pneumatically placing the AN, and continued to experiment with the process. IMC has now adopted the technique for use throughout its Carlsbad, N. M., potash mining operation and has found that it is safe, effective and economical.

SILICON RECTIFIERS

Hanna's Ireland mine in West Virginia is "sold" on silicon rectifiers, believing they are the most economical, reliable and simplest conversion units on the market today. This factual review of Ireland's experience delves into all phases of the equipment—everything from initial cost and efficiency to ease of moving and simplicity of maintenance. Of special interest is a section on regulated versus unregulated rectifiers.

RADIATION CONTROL IN URANIUM MINES AND MILLS

Potential hazards from radiation in uranium mining and milling are small compared to those in other phases of the atomic energy industry. Nevertheless, controls are needed to protect workers from the radioactivity in natural uranium and its various decay products. This article emphasizes control measures required to meet Federal regulations and discusses practical approaches to establishing an effective radiation control program.

ECONOMICS OF LARGE TIRES FOR EARTHMOVING EQUIPMENT

One of the most crucial factors affecting haulage costs is tire life. As operators go to larger capacity haulers, tires become increasingly important since they are the largest single item in vehicle operating expense. The author mentions several factors that affect tire life, discussing in detail the major problem of premature failure due to excessive heat. Recent advances in tire construction and design are also covered.

MAINTENANCE COSTS REDUCED BY REDESIGN OF FINE COAL CLEANING PLANT

"Too much plant for the amount of coal being processed"—that was the key maintenance problem at one of Pittsburgh Coal Company's facilities cleaning $\frac{3}{8}$ in. by 0. The solution was to simplify the flow-sheet. This concise report explains how four drag tanks, a distributing conveyor, four cyclones and two large pumps were successfully eliminated from the 240 tph cleaning plant.

AUTHORS



A. V. Mitterer



B. T. Phillips

search Foundation. Phillips joined IMC in 1956 after several years in petroleum exploration.

C. L. Sarff's mining experience dates back to 1932 when he joined Hanna Ore Mining Co. From 1935 to 1953

he was with Hanna Coal Co., serving as chief electrical engineer, maintenance superintendent and preparation engineer. In 1954 he joined White Pine Copper Co. as chief mechanical engineer, but returned to Hanna Coal in 1956 as chief engineer of Ireland mine.



Robert G. Beverly has been administrator, radiation controls with Union Carbide Nuclear Co. since 1959. He was previously with National Lead Co. for five years and became manager of its uranium pilot plant at Grand Junction, Colo. Prior to that,

he was at the Rifle, Colo., Oil Shale Demonstration Plant of the USBM for six years.

G. E. Danby has been manager of the Sales Development Department, Euclid Division, General Motors Corp. since 1959, having joined the company's sales department in 1956. He has worked in earthmoving equipment sales since 1948, prior to which he was a field engineer



on dam construction for the Ontario Hydroelectric Power Commission.



David G. Werner, maintenance engineer, Pittsburgh Coal Co., Division of Consolidation Coal Co., has devoted many years to the field of coal preparation. He believes that a plant must operate efficiently with a minimum number of delays, and more im-

portant, within a reasonable cost.

Now, load faster, more safely than ever before...

NEW GARDNER-DENVER "WORK

MODEL GD18

Controls for traction and dipper action placed for ease of operation—no mechanical linkages.

Chain equalizer bar shaft

Full 9-cu.-ft. dipper capacity.

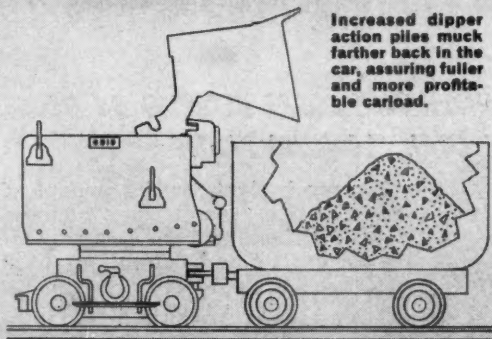
Upper deck pivots on tapered roller bearings.

Heavy-duty, rugged, positive clutch.

SPECIFICATIONS

Clean-up width	105"
Track gauge	18" to 36"
Weight—Standard	7530 lb.
High	7950 lb.
Dipper capacity	9 cu. ft.
Traction motor hp	15 at 90 psi
Dipper motor hp	17 at 90 psi
Necessary air pressure	50-100 psi
Size air connection	1½"

MORE PAY LOAD



Increased dipper action piles much farther back in the car, assuring fuller and more profitable carload.

HORSE" MINE CAR LOADER

4 BIG REASONS WHY THE GD18 IS YOUR BEST BUY—ANYWHERE

MORE POWER—Highly increased dipper and traction motor hp. And you can use every bit of it. Weight distribution and force leverages are balanced with this extra hp.

UNMATCHED PERFORMANCE

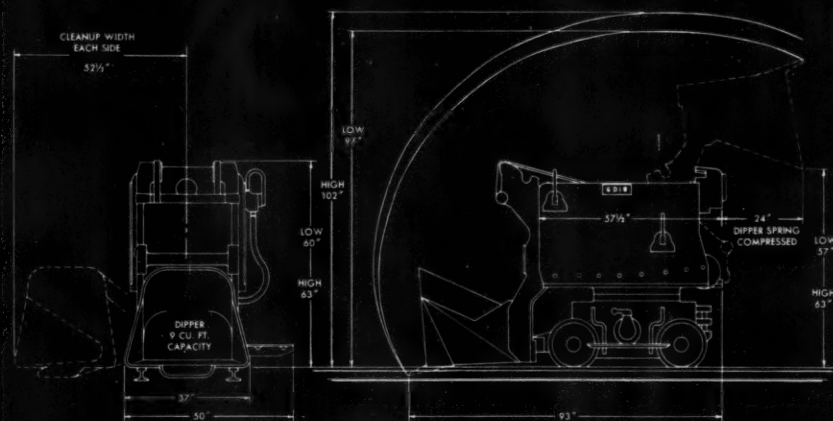
—Faster loading rate per car—proved by actual competitive tests in iron ore at any pressure from 50 to 100 psi. You get more tons per car-load—increased dipper power throws muck peak farther back in the car.

PROVED RELIABILITY—Years of extensive field testing *proved* the design . . . *proved* low operating and maintenance costs . . . *proved* increased production with fewer delays.

MAXIMUM SAFETY

—Excellent weight distribution provides stability regardless of track gauge—better than any other loader. Reliable centralizing and minimum effort, required to position dipper, safeguard operator . . . enable him to get high performance with ease.

DIMENSIONS



OTHER FEATURES

- Smooth, positive centralizer action
- Easily converted to high or low construction
- Traction and dipper motors have same internal parts
- Five-cylinder radial air motors
- Three-point lubrication
- Crown-shaved gears
- Single, enclosed shock spring for dipper
- Steel wheels
- Unitized component assemblies—interchangeable
- Self-cleaning dipper arm guides



EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Ill.—Offices in principal U.S., Canadian and Mexican cities.
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario.

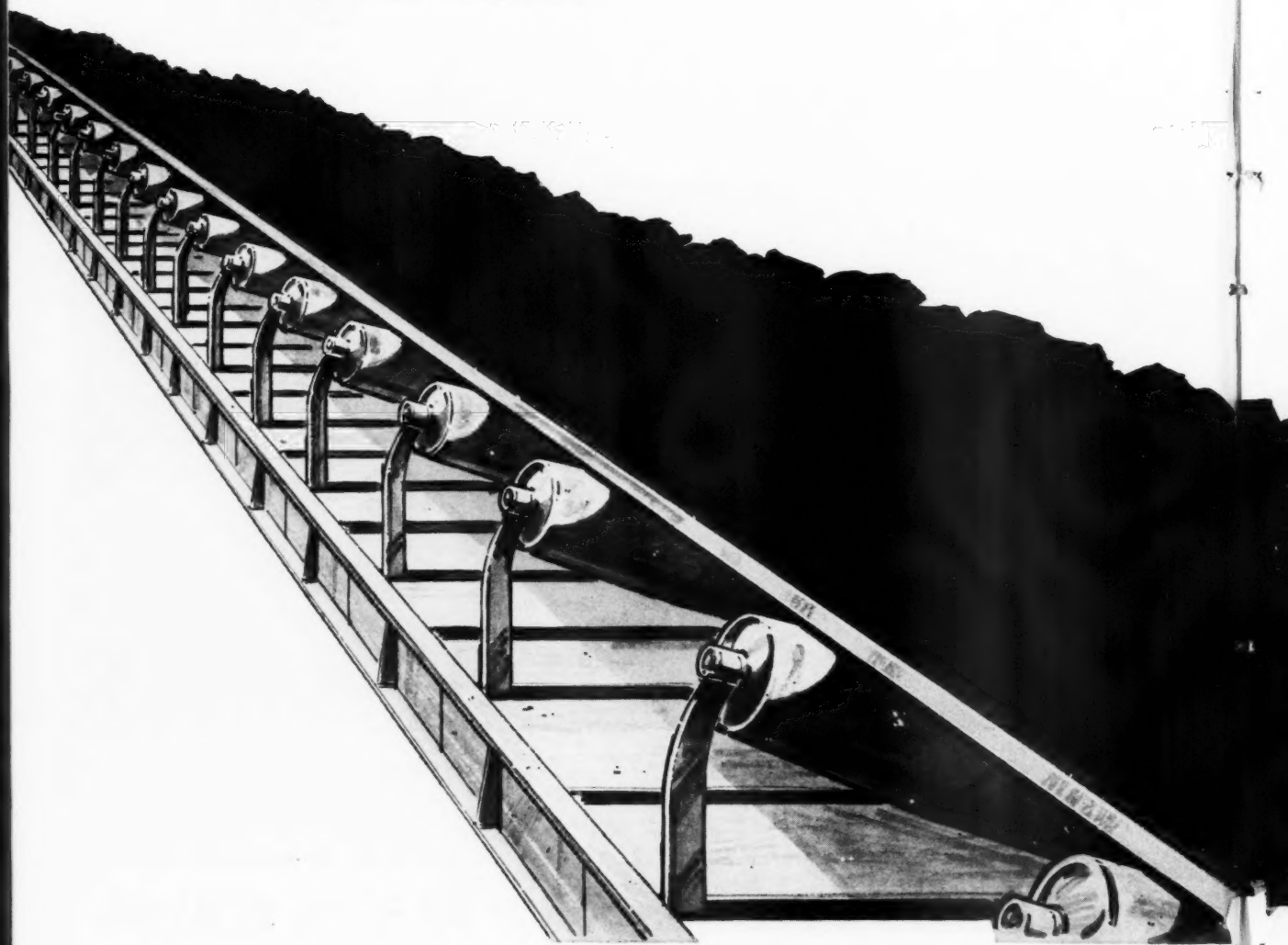
International: Gardner-Denver International Division, 233 Broadway, New York 7, N. Y.
Offices: Buenos Aires, Argentina; Artarmon, N. S. W. Australia; Brussels, Belgium; Rio de Janeiro, Brazil; Santiago, Chile; Barranquilla, Colombia; Lima, Peru; Ndola, N. Rhodesia; Salisbury, S. Rhodesia; Johannesburg, Transvaal

FROM DRILLING TO CLEANING...

AMERICAN CYANAMID

*helps the Glen Alden Corporation
produce world famous*

BLUE COAL!



from drilling to cleaning, specify

in the mine...

American Cyanamid is one of Glen Alden's prime suppliers of explosives and blasting accessories. At Wanamie #19, for example, where all coal is blasted from the solid, American 12 A ($\frac{1}{2}$ x 8) Permissibles are used.

Ross and Red Ash veins are being worked and the explosives used permit working faces to be advanced rapidly and efficiently. Blasting pattern affords space for blasted material to be moved out with each firing round. Number of holes per cut average 10 or 12 with 5 to 7 sticks per hole. Coal is loaded mechanically and by hand for transfer to surface.

Cyanamid offers the coal industry 12 American permissibles with a variety of low, medium and fast rate powders in a wide range of densities. There's a correct grade for every requirement! To enable you to enjoy the benefits of multiple shooting, we supply COAL KING® Delay Electric Blasting Caps in 15 delay periods and a variety of leg wire lengths.

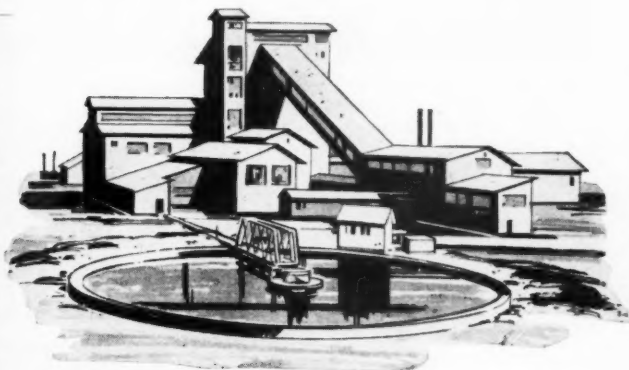


in the breaker...

Wash water effluent from washing anthracite flows to a 120 foot diameter thickener at the rate of 12,000 gallons per minute, carrying 50 tons of solids per hour for clarification. 15 pounds of AEROFLOC® 3171 Reagent per 7-hour shift is fed as a 1.0% solution to the wash water launder. Slimes are settled fast leaving clear thickener overflow.

Other Cyanamid chemicals for the coal industry include AEROFLOC® 550 and 3000 Reagents and SUPERFLOC 16® Flocculant to remove solids from effluents. AEROFROTH® 65, 73 and 77 Frothers to float fine coal particles away from refuse, AEROSOL® OT-75% to improve wetting power of sprays to allay dust, AERO® Depressants to reduce frothing and foaming of coal slurries and AEROSPRAY® 52 Binder to cut wind loss of exposed fines in storage or shipment.

Our experienced representatives will assist you in the best selection and use of our products. Prompt delivery is assured.



CYANAMID

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Explosives • Blasting Caps and Accessories • Blasting Agents • AM-9 Chemical Grout • Mining Chemicals

A Typical Day with a Hercules Representative



AN EARLY START enables Bob Shiel, Hercules technical serviceman, to observe step-by-step blasting procedures at his customer's mine.



CLOSE CONTACT between Bob and the mine superintendent eliminates most blasting troubles, and increases the operating economy of the mine.



UNDERGROUND with the tools of the trade, Bob examines some of the cars of blasted material to determine the effectiveness of the explosive charges.



BLASTING-PROCEDURE observation is a part of Bob's work. It takes the guesswork out of his job, and enables him to specify the proper explosives.



SHOP TALK helps find out if the remedy he's suggested has cured this mine's troubles. Bob's background gives him the insight necessary to make intelligent recommendations.



CHECKING and rechecking all the recommendations he has made gives Bob the satisfaction of knowing that he has been of assistance in solving his customer's blasting troubles.

Around the nation — around the clock

THERE'S ALWAYS A HERCULES MAN READY TO HELP YOU

Bob Shiel, E.M., Ohio State, is just one of the many specially trained Hercules men serving the explosives-consuming industries. For years Hercules has employed men with engineering training to sell and service its explosives throughout the United States and in many foreign lands. Our experience has proved that men with engineering training can meet their customers on common ground. They speak the same

language, for most of the men who direct explosives-consuming work are technically trained.

When a young engineer starts his training as an explosives sales engineer with Hercules, he begins a period of orientation. He is then sent to our explosives plants and laboratories for thorough groundwork in products and processes. Upon completion of this indoctrination, he visits various sec-

tions of the country where he learns how explosives are used in underground and open-pit mines, rock quarries, heavy-construction jobs, and seismic exploration.

The cornerstone of Hercules Explosives Department is based on men who have the know-how to handle blasting problems quickly, efficiently, economically. To take advantage of this specialized service, call or write.



Explosives Department
HERCULES POWDER COMPANY
INCORPORATED
Hercules Tower
910 Market Street
Wilmington 99, Delaware



BIRMINGHAM, ALABAMA • CHICAGO, ILLINOIS • DULUTH, MINNESOTA • JOPLIN, MISSOURI • LOS ANGELES, CALIFORNIA • NEW YORK, NEW YORK
PITTSBURGH, PENNSYLVANIA • SALT LAKE CITY, UTAH • SAN FRANCISCO, CALIFORNIA



One sweep* SAVED ITS COST...

Cleaning up several miles of track, once over, paid for original cost of machine. (Name on request.) Hydraulic controls of digger plate and side plows expedite a thorough cleaning job in one pass. Mine inspectors insist on clean haulage roads. Hazards of unsure footing and accumulation of explosive dust are minimized by cleaning the haulage ways with the "Canton" Custom-made to specifications. In use . . . coal, iron, copper, potash, lead and salt mines, also smelter skim tracks.

Other self-liquidating equipment . . . Mechanical or Air-operated Mine Doors, Air or Manual-operated Car Transfers, Electric or Air-operated Track Switch Throwers, Wet or Dry Rock Busters, Cable Splicers. Write for full descriptive brochures.

American Mine Door Co.
2063 DUEBER AVE. S.W. CANTON 6, OHIO

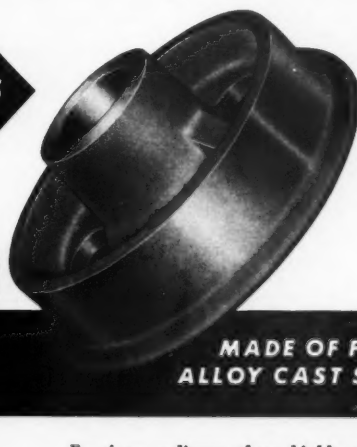


FARRELL-CHEEK ALLOY CAST STEEL MINE CAR WHEELS AND HIGH PERFORMANCE PARTS



Essential parts for every mining operation, cast from finest carbon and alloy steels.

Wheels and Rollers •
Sheaves and Wire
Rope Fittings •
Chain, Sprockets and
Buckets . . .



MADE OF F85
ALLOY CAST STEEL

Far from ordinary, these highly specialized mine car wheels, electric furnace cast of F85 alloy steel, are establishing new performance and service life records in actual use. A Brinell of 350-400 is provided on treads and flanges with a high degree of ductile toughness in hubs and webs.

You'll want complete information on all F-C wheels and parts for mining. WRITE TODAY!

Finest Name in Cast Steel!

FARRELL-CHEEK STEEL CO.

110 LANE STREET, SANDUSKY, OHIO

"FOUNDRYMEN
FOR OVER
FIFTY YEARS"



Mammoth Coal Co. chose Haulpaks® for:

- ① more trips per day**
- ② lower maintenance costs**

Take it from Mammoth Coal Co., of Raven Run, Pennsylvania...one of the surest...and quickest ways to reduce off-road hauling costs is to use LeTourneau-Westinghouse Haulpaks. Here, Mr. Walter C. Bohler, shop foreman for Mammoth Coal, tells you why.



"Our operation here at Mammoth Coal is tough on trucks. This anthracite coal weighs 1800 lbs per yd, and overburden (mostly rock), 2600 lbs per yd, so when our 6-yd shovel drops a dipperful into a truck, it's quite a jolt. And our trucks work 13½ hours a day, loading in restricted areas, hauling capacity loads up to 7 miles with grades to 13%.

"How have our two 32-ton Haulpaks been performing? ... Well, we find operating expenses *greatly reduced*. One of our Haulpaks has run 400 hours without even a body dent ... the other has needed only minor repairs. We will also save money when servicing these units, because they have *fewer components* than our other trucks of similar capacity. In addition, the Haulpaks use less fuel — 20 gallons less per 7-hour shift!

"Another important Haulpak advantage we like is its short turn radius. Since our trucks usually have to load in narrow areas between steep pit walls, we find Haulpaks can get in-and-out of loading areas with no time wasted jockeying back-and-forth. This saves us valuable time and permits our Haulpaks to complete as many as 3 extra cycles per day!"

TWO MORE LW Haulpaks were delivered to Mammoth Coal at the time this report was ready for printing. Further proof of satisfied performance! Mammoth's new Haulpaks have 550 hp, 60-ton capacity.

Mammoth's 6-yd shovel loads Haulpak with capacity load fast. V-body gives you bonus yardage within an exceptional short wheelbase. Maneuverability: 32-ton Haulpak makes 180° turn in area only 44'6" wide.



Another load of overburden at Mammoth Coal Co. is dumped in a hurry! Haulpak's twin 3-stage hoists lift body in seconds to a high angle for fast, complete ejection of load. Body is exhaust heated, prevents materials from freezing and sticking. There's no load "carry-back" problem with Haulpak.

32-ton Haulpak highballs load over mine road for Mammoth Coal Company. LW's exclusive Hydrair® suspension cushions against loading and travel shock ... keeps unit riding level.



Want to learn how LeTourneau-Westinghouse Haulpaks give you lowest net cost per ton-mile? We'll be happy to show you! Five sizes, 22 to 60 tons, up to 550 hp. Ask to see our 15-minute film, "Revolution on Wheels". No obligation.

HP-2302-MJ-2

VISIT US AT THE COAL SHOW IN CLEVELAND, MAY 15-18th, BOOTH NO. 1723

LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



CONTINUOUS MINING

Extra productivity

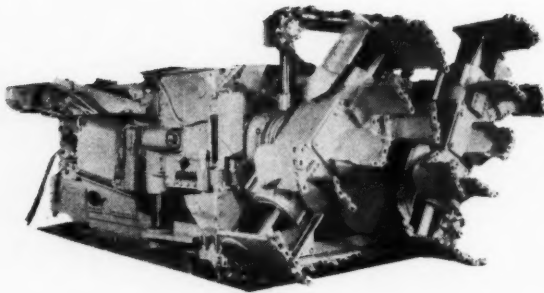
... CONTINUOUS BORER



Goodman borers are rugged machines that have all the capacity, power and practical mobility needed for any phase of development work, room driving and pillar recovery. They are consistently developing areas at a rate of advance ranging from 200 to 300 lineal feet per machine shift; are producing tonnages in excess of 90 tons per face man for an entire mine. Low maintenance has been outstanding—at one mine a borer produced

over one million tons of coal without need of an overhaul. At another property, six borers worked steadily for 2 years without an overhaul date even being scheduled.

This high tonnage, low down-time combination is built into every Goodman borer. It keeps men and machines at the working face—produces more coal with less supervision, makes the capital invested look better with each production report.



Goodman borers cut a path with arched rib and roof for natural support, produce a high percentage of coarse coal for maximum dollar yield.

GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place, Chicago 9, Illinois

with GOODMAN EQUIPMENT

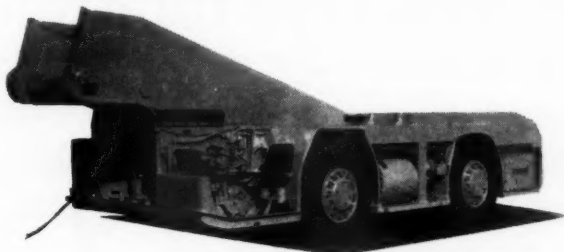
at low cost per ton

... SHUTTLE CAR



NEW—Now for big hauls use Goodman 1070 AC 10-ton shuttle car with 80 hp traction motor and a 26 hp motor for conveyor drive and hydraulic system. There are two tramping speeds without the use of clutches and torque converter . . . simple electrical, mechanical and hydraulic systems. Planetary type wheel units lessen wear on tram mechanism and produce high torque at wheel hub where needed. 10-ton capacity can be increased with sideboards.

The 1070 is available in basic heights of 44" and 49" and widths of 96" and 106". Ground clearance is 11½".



... ROPEBELT® CONVEYOR



Practical for use anywhere in your mine—development headings, production panels, on main line or slope. Whatever its application, ground mounted or roof suspended, it pays off in speed of installation, high capacity, and low maintenance. Superior carrying capacity is particularly important for accepting coal from shuttle cars servicing continuous miners, and for mainlines that carry a mine's total production. Entire Ropebelt units can be quickly recovered and reinstalled.

Two improved Goodman full-flex carrying idlers available—the full-flex linked type, and full-flex low rope type that raises wing rollers above wire ropes (illustrated). Carrying capacity of both increases under load.



See it all at the Goodman Exhibit . . . 1961 Coal Show

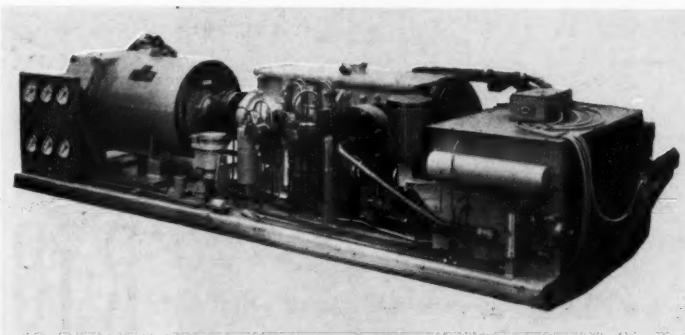
A complete line of equipment for continuous and conventional mining systems.



OPEN PIT OR UNDERGROUND — PUT POWER WHERE YOU NEED IT
POWER above ground or at the face—for shuttle cars, hoists or shovels... lighting
 or communication...tools or blasting—wherever you want power in a mine, think
 of General Cable first! It's the world's most complete line of wire and cable—
 and you'll find ample stocks near every mining center. For
 power where you want it, when you want it — rely on **GCC**
 General Cable Corp., 730 Third Avenue, New York 17, N. Y. GENERAL CABLE CORPORATION

CABLE FOR ANY MINING APPLICATION! ■ Super Service power cables ■ Borehole cable, armored or non-metallic armored ■ High-voltage shielded power cable
 Portable cable, 600V rating, 3/C or 4/C, Type G, PG, PCG ■ Portable cable, 600V rating, Type W ■ Blasting wire and shot firing cord ■ Communication products

The Armstrong AIRBREAKER* System . . .



- More Large Coal — Less Fines
- Greater Safety
- Operational Simplicity
- No Fumes or Smell
- Lower Cost

. . . For Blasting Coal with High Pressure Air

The Armstrong *Airbreaker* System represents a modern and versatile method with which coal (or other minerals) can be prepared for loading operations. It can be applied to Longwall, Room and Pillar and Steep Seam methods of working, and is equally effective in cut or uncut coal. The System comprises a compressor, pipeline and Armstrong blasting shells, through which the high pressure air is discharged to break out the coal.

See our Exhibits on Stand 112 at the Cleveland Coal Show

OLIN MATHIESON LTD., 17-18 OLD BOND STREET, LONDON W.1

*Trademark of Olin Mathieson Chemical Corporation

FOR SALE

2—6 cu. yd. Bucyrus Erie Model 150B Comb. Shovel-Dragline Units	\$210,000.00 ea.
10—15 cu. yd. Euclid Mod. 63TD End Dumps	24,000.00 ea.
5—15 cu. yd. Euclid Mod. 46TD End Dumps	24,000.00 ea.
10—30 cu. yd. Athey Mod. PW20 Bottom Dump Trailers only	13,000.00 ea.
12—30 cu. yd. Mod. MX30 Southwest Bottom Dump Trailers	5,000.00 ea.
10—DW20 Cat Tractors w/30 cu. yd. Mod. PW20 Athey Bottom Dump Trailers	27,000.00 ea.
8—Mod. LRVX Mack Tractors w/30 cu. yd. Mod. 137W Euclid Bottom Dump Trailers	36,500.00 ea.
4—D9 Cat Tractors w/PCU's & Dozers, 18A Series	26,500.00 ea.
8—D8 Cat Tractors w/PCU's & Dozers, 14A Series	16,500.00 ea.
2—Mod. 33LDT Euclid Pneu. Tired Scraper Units	27,000.00 ea.
10—DW20 Cat Scraper Units w/Modified Bowls	27,000.00 ea.
1—6' x 6' "Special" D.D. Sheepsfoot Tamper, U.S.B.E. Specs.	7,500.00
1—6' x 16' Koehring Smooth Faced Sealing Roller, 50,000	3,500.00
2—Mod. 12 Cat Motor Patrols, Cabs & Hyd. Shift Mole Boards	8,000.00 ea.
2—Mod. 200 Rex Double Pumpcretes, Electric	7,500.00 ea.
2—60" x 20' Link Belt H.O. Mang. Apron Feeders w/Drives	12,500.00 ea.
2—30" x 60" Single Roll Gruendler Crushers w/Drives	9,500.00 ea.
1—6' x 12' Tyler F800 Single Deck Screen w/Drive	6,000.00
Approx. 2 Miles 42" and 48" Channel Frame Conveyor System in Flights of 150' to 1885' Price on Application	

CALL, WIRE or WRITE for Complete Bulletin!

TRINITY DAM CONTRACTORS

10 West Orange Avenue

Phone: PLaza 6-0300, Ext. 279

So. San Francisco, Calif.



***There's a "Euc" Rear-Dump
just right for your work!***

Whatever your mine and quarry hauling job may be — stripping overburden, waste disposal, moving ore, rock and other materials — there's a type and size of job proved Euclid that can cut costs and step up production. With unmatched field experience and the parts and service facilities of a world wide dealer organization, "Eucs" meet every requirement for big performance on the toughest jobs. For facts and figures proof that Euclid work-ability can mean lower costs and bring a better return on investment, call the Euclid dealer in your area.

EUCLID Division of General Motors, Cleveland 17, Ohio
Plants at Cleveland and Hudson, Ohio and Lanarkshire, Scotland



EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

R-10 10
TONS

R-15 15
TONS

R-18 18
TONS

R-22 22
TONS

R-27 27
TONS

R-45 45
TONS

R-62 62
TONS

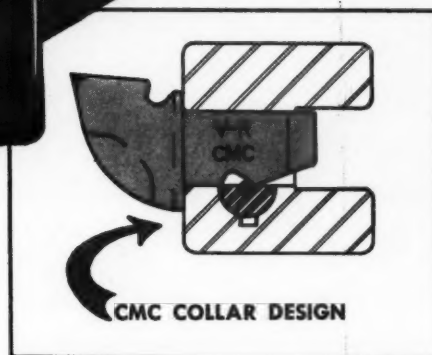
PLUS

**12, 22 and
35-TON**

**Semi-Trailer
Rear-Dumps**



**LATEST
DESIGN
fits
quick change block
perfectly**



Latest design style CMC Red Bits features a new, all-around collar that increases bit, lug and retaining pin life — gives the following advantages:

1. Perfect fit in quick change block — bit seats solidly with no wobble.
2. Collar bears equally on all sides — gives uniform wear on lug.
3. Collar keeps fines from packing in lug — bit changes are quicker and easier.

Cylindrical carbide tips, brazed into cylindrical pockets, enable these new bits to withstand extremely rugged cutting conditions. These carbide tips, manufactured by V-R, are quality-controlled from ore to finished product. Use the bits that are the first choice of miners everywhere — put V-R style CMC Red Bits to work on your equipment today.

SEE THEM AT
THE COAL SHOW
BOOTH 2150



CREATING THE METALS THAT SHAPE THE FUTURE

VASCOLOY-RAMET

834 MARKET STREET • WAUKEGAN, ILLINOIS

M-821

AT THE HEART OF INDUSTRY...



Serving the famed Moss #3 Mine of Clinchfield Coal, Duty, Va., 48"-wide U.S. Rubber MineHaul main haulage belts, each more than a half a mile long, carry 3,000 tons each per shift. These belts, in turn, are fed by a number of 36" panel belts. The fact that most of the belting used in this six-million-tons-a-year mine was made by US reflects U.S. Rubber's position as the world's leading authority on conveyor belting.

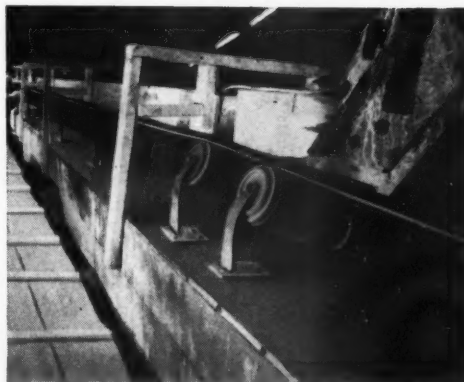
CB 101

At the heart of the coal mining industry, you'll find US...with the industrial rubber products that provide "minimum mining maintenance." See how and why U.S. Rubber products serve you better, cost you less. See Booth 801 at the 1961 Coal Show in Cleveland.



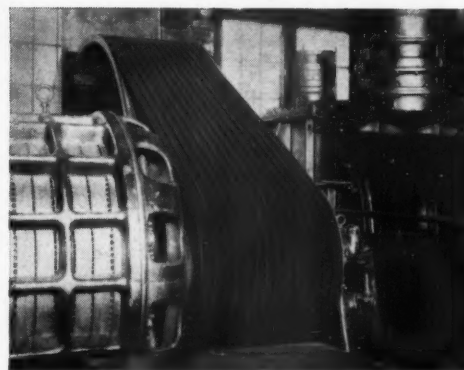
Long after other hose have failed from the cuts, abrasion, and abuse of heavy-duty work, U.S. Matchless® Air Hose can be seen powering equipment at mining and construction sites everywhere. Its unique ability to withstand the toughest treatment is but one reason why U.S. Rubber is the largest producer of hose in the world, with a complete line of hose for every industrial need.

H 101



Dramatically reducing maintenance and down-time for conveyor belt installations everywhere, patented U.S. Searle Sleeves protect rollers against impact damage, corrosion, build-up of wet muck, fines, and abrasive dusts. Belt wander is eliminated, edge wear greatly reduced, troughing substantially improved. Both belt and idler rollers wear far longer.

SS 101



Cut costs, reduce maintenance, avoid shutdowns. In mines across the country, U.S. Royal V-Belts power fans, pumps, compressors, generators, conveyors—equipment that demands the maximum in reliability for safety as well as profit. U.S. Royal V-Belts are known throughout industry for their exceptional length stability, uniformity, and long service on drives of all kinds and sizes.

VB 101

For every industrial rubber product need, turn to U.S. For Conveyor Belts, V-Belts, the original PowerGrip "Timing"® Belt, Flexible Couplings, Mountings, Fenders, Protective Linings... custom-designed rubber products of every de-

scription. Discover why U.S. Rubber has become the largest developer and producer of industrial rubber products in the world. See your U.S. Rubber Distributor or contact **US** directly at Rockefeller Center, New York 20, N. Y.

WORLD'S LARGEST MANUFACTURER
OF INDUSTRIAL RUBBER PRODUCTS



United States Rubber
MECHANICAL GOODS DIVISION

TRAMS OVER AND UNDER OBSTACLES

Lee-Norse CM38



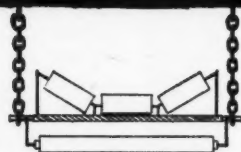
"TOUCH AND GO" VERTICAL ACTION

OVERHEAD EQUIPMENT

LIKE
THIS

NO BAR TO FAST, FREE OPERATION

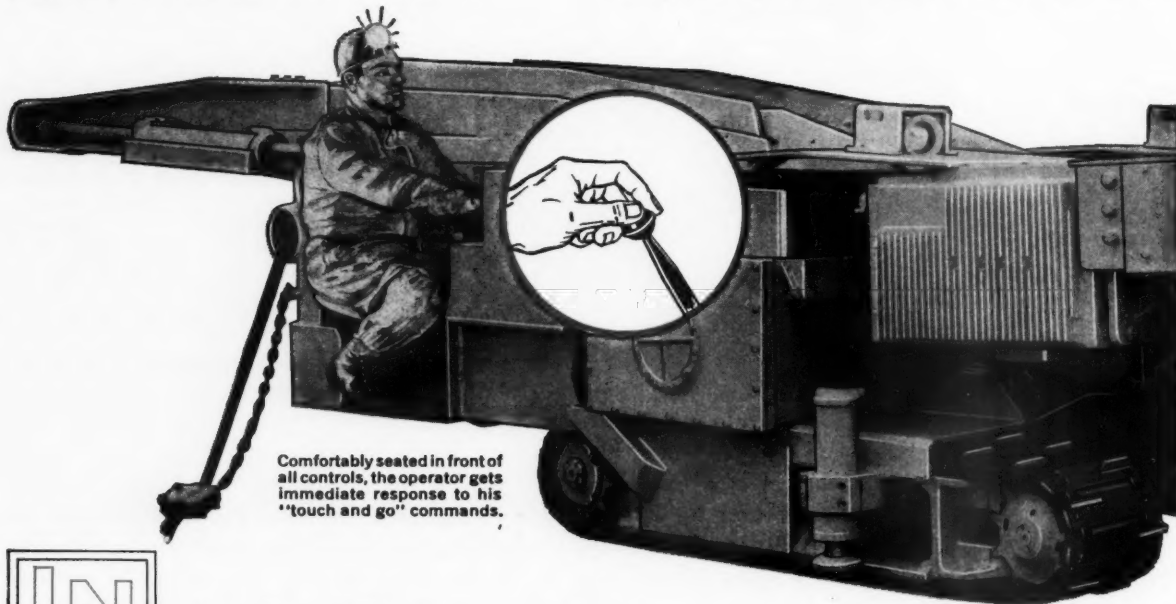
BELT
CONVEYOR



HEAVED BOTTOM — NO OBSTACLE TO TRAMMING

"Touch and Go" vertical action sends these modern miners to the face, cutting deeper and higher . . . trams them without stoppages from obstacles above or below.

Lee-Norse Miners take heaved bottoms in stride; negotiate overhead obstructions! Low tramming action assures ease of maneuverability—over or under—with "Touch and Go!"



Comfortably seated in front of all controls, the operator gets immediate response to his "touch and go" commands.



Lee-Norse Company

CHARLEROI, PENNA.

SPECIALISTS IN COAL MINING EQUIPMENT

Coal High or Low?... *Lee-Norse* MINERS keep production on the go!

-CUTS HIGH AT THE TOUCH OF A FINGER and **CM48 MINERS**

gives the Lee-Norse Miners these 3 features:

1. TRAMS LOW—CUTS HIGH

2. CONTROLLABLE CUTTING HEIGHTS

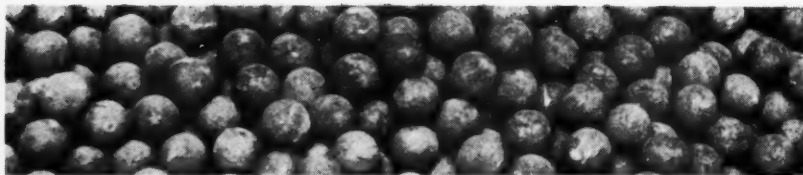
3. SELECTIVE MINING ABILITY

Uneven seams—high or low—they make no difference! Those powerful cutters spin just as fast and efficiently at 42 inches as they do at 120 inches.

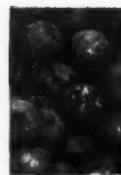
Finally, the Lee-Norse Miner, with these low tramming and high cutting features will up your production and flatten out your operating and maintenance costs.



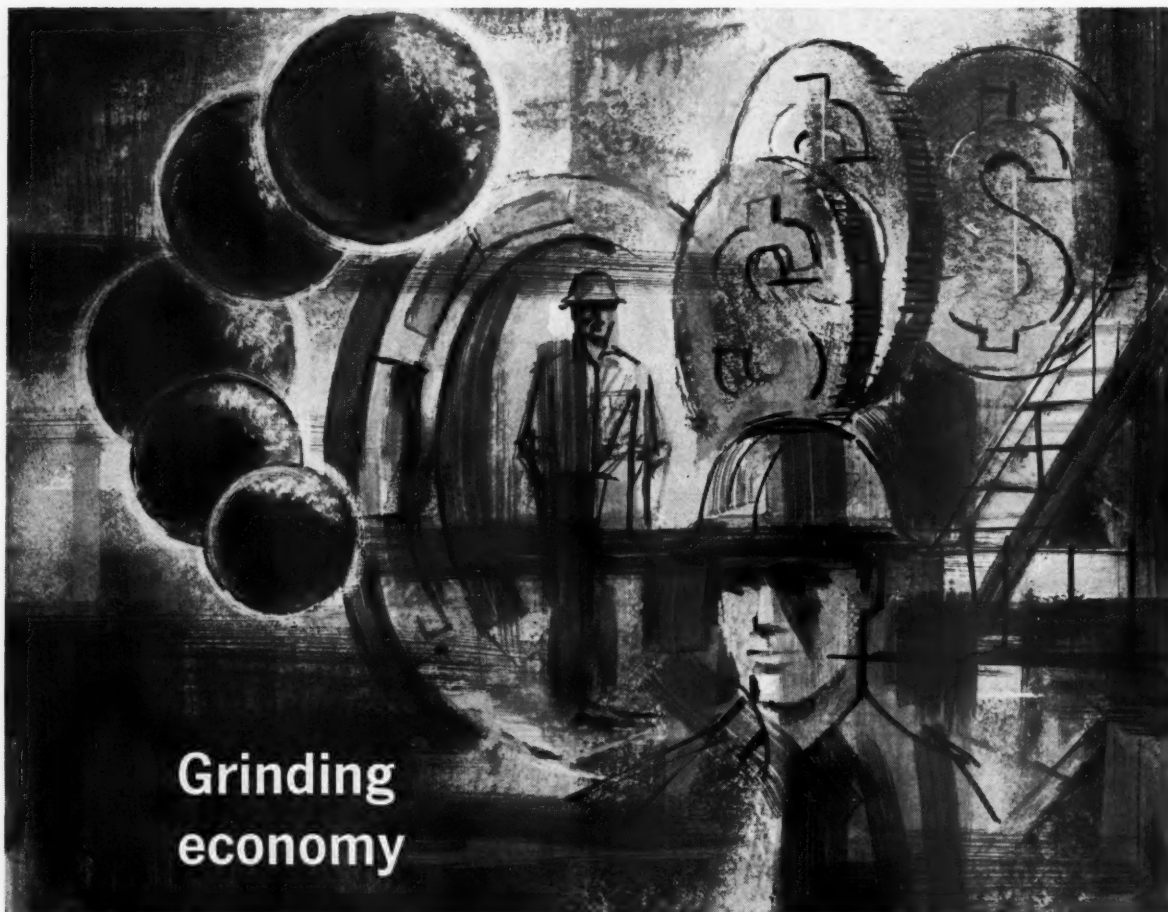
VISIT US
at our exhibit
In the ARENA . . .
COAL SHOW



Strong
Tough
Economical
Efficient
Lasting



SHEFFIELD MOLY-COP Grinding Balls



**Grinding
economy**

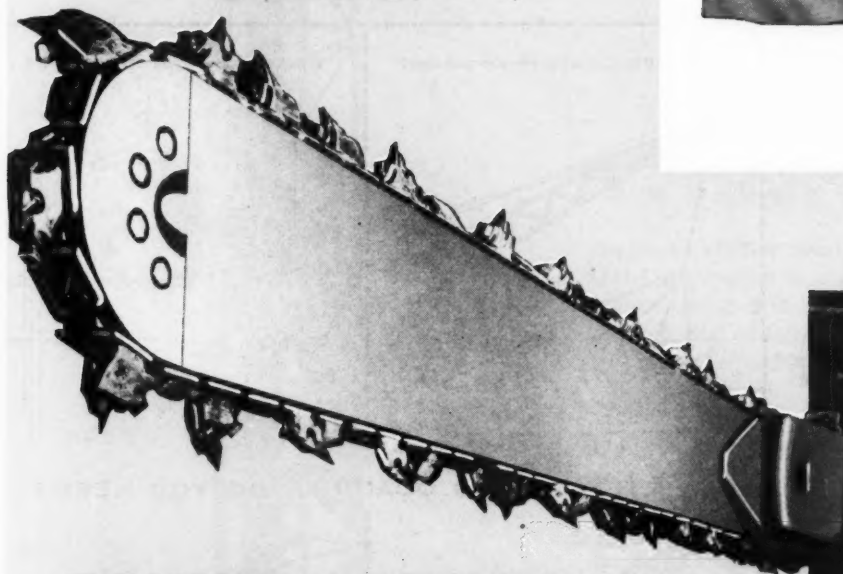
has earned customer acceptance

Over a million tons of Sheffield Grinding Balls have proved that Moly-Cop quality will give you better grinding at lower cost. What's behind this fine performance? Hardness, toughness and uniformity. Hardness to fight wear. Toughness to resist spalling and breaking. And uniformity of fine grain structure right to the core. That's why Moly-Cops keep their spherical shape longer, require fewer chargings and less down time, and save you money in the long run. **Sheffield Plants: Houston, Kansas City, Tulsa.**



Sheffield Division

it's what's up front
that
cuts!



BOWDIL 1-29 BITS . . .

CONCAVE SHAPE STAYS SHARP AS IT WEARS AWAY. THAT MEANS

- | | |
|---------------------------|------------------------|
| 1. EASIER CUTTING | 6. LESS DRAG |
| 2. FASTER CUTTING | 7. LESS POWER CONSUMED |
| 3. COARSER CUTTINGS | 8. LESS DOWN TIME |
| 4. MORE PROFITABLE STOKER | 9. LESS MAINTENANCE ON |
| 5. LESS BUG-DUST | MINING MACHINES |

. . and the double point doubles your savings!

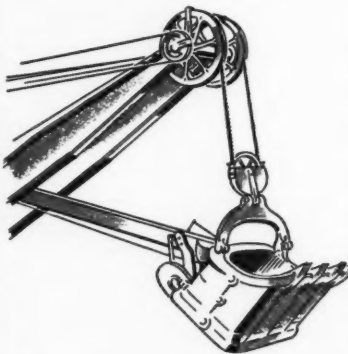
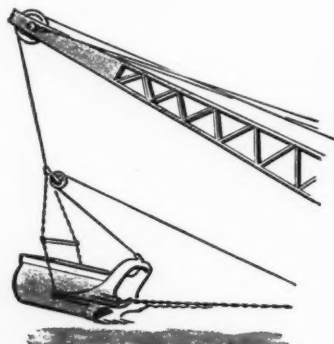
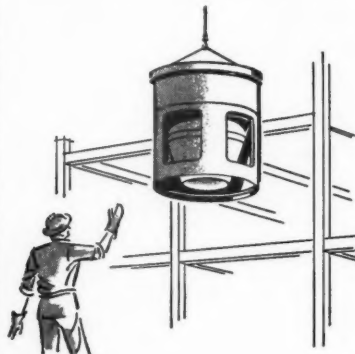


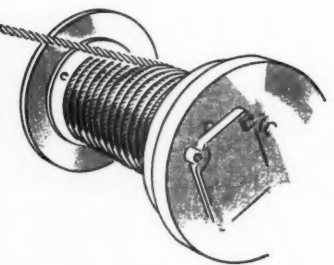
AT THE SHOW
BOOTH 1006

The **BOWDIL** *Company*
CANTON, OHIO

*ORIGINATORS OF THROW-AWAY BITS; MANUFACTURERS OF BARS,
BITS, CHAINS AND OTHER PRODUCTS FOR COAL MINING; CUSTOM
MACHINERY DESIGNERS AND BUILDERS; HEAT-TREAT SPECIALISTS;
SALES AGENTS FOR THE CINCINNATI ELECTRIC DRILL

Is "any old" wire rope out of "any old" stock good enough?

Not when you can get what you need from the best combination of wearing qualities in the right Macwhyte!

<p>NEED EXTRA STRENGTH?</p> 	<p>NEED RESISTANCE TO ABRASION?</p> 	<p>NEED A NON-ROTATING ROPE?</p> 
<p>WHICH COMBINATION OF THESE WEARING QUALITIES DO YOU NEED?</p>		
 <p>NEED RESISTANCE TO CORROSION?</p>	 <p>NEED RESISTANCE TO BENDING FATIGUE?</p>	 <p>NEED RESISTANCE TO CRUSHING?</p>



Booth 813
at Coal Show

You can place your trust in Macwhyte Distributors to give you the right wire rope for your equipment.

Macwhyte manufactures a thousand and one wire ropes to give you the right combination of wearing qualities your equipment demands.

For lowest-cost service, ask for the

right Macwhyte wire rope specially suited to your equipment. Circular 6025, free on request, explains why you can save with the right wire rope on your equipment.

ASK ABOUT MACWHYTE'S NEW 7-FLEX® WIRE ROPE

MACWHYTE WIRE ROPE COMPANY 2900 FOURTEENTH AVENUE
KENOSHA, WISCONSIN

Wire Rope Manufacturing Specialists since 1896



THINK BIG

Bigger and better than its predecessors, the QM-5 is designed to make Swiss cheese of granite and to drill holes up to 9" bore size at a rate that will give a production of up to 457 tons per hour with lowest bit cost per unit of production.

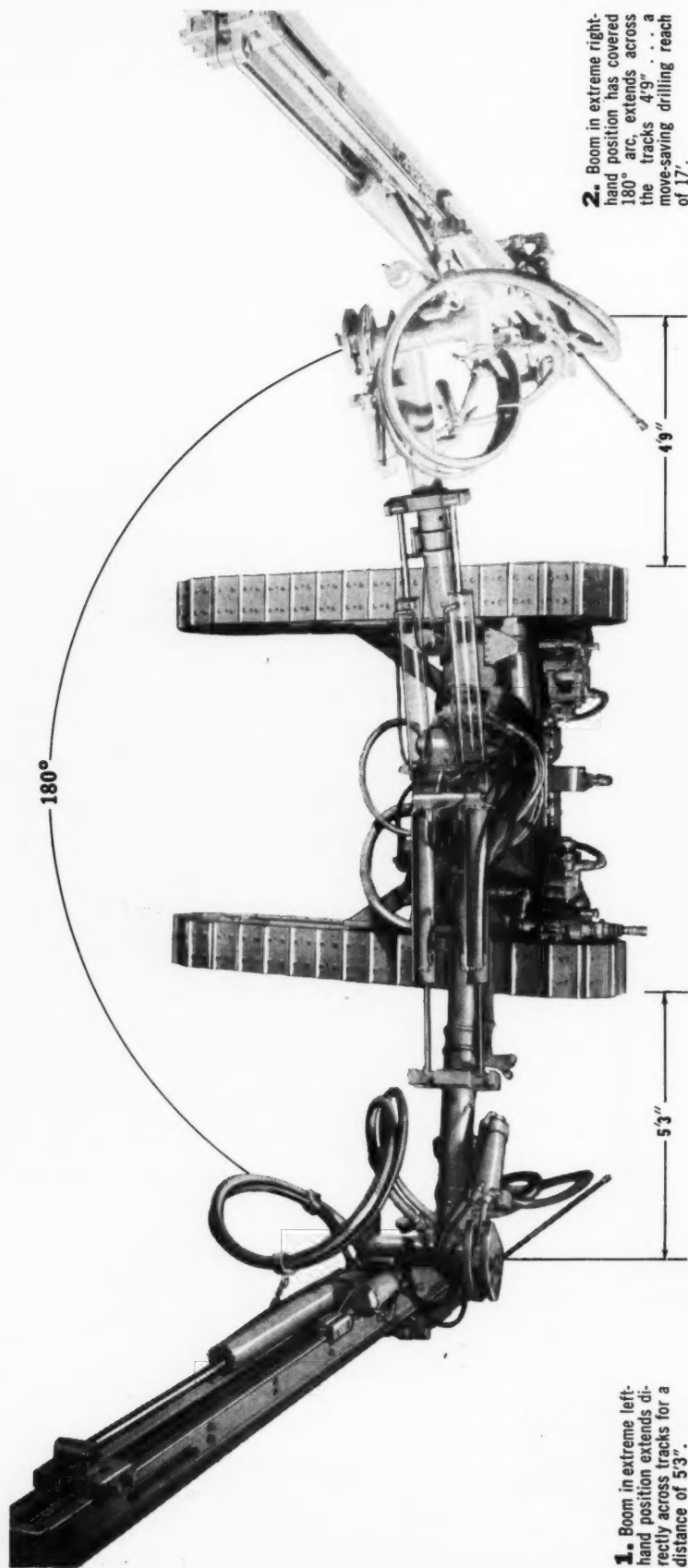
New features include angle drilling to 25 degrees, a maintenance-free ejector type dust collector, enclosed operator's cab and full working platforms. Also, choice of famous DHD-500 and DHD-400 Downhole drills for hole sizes from 7½ to 9 inches. Air power is supplied by two Gyro-Flo 900 rotary compressors available in diesel or electric drive.

Ask your Ingersoll-Rand sales engineer for the full Quarrymaster story.



Ingersoll-Rand.
228A5 11 Broadway, New York 4, N. Y.

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK



1. Boom in extreme left-hand position extends directly across tracks for a distance of 5'3".

2. Boom in extreme right-hand position has covered 180° arc, extends across the tracks 4'9" . . . a move-saving drilling reach of 17'.

TRACDRIL'S 180° "BOARDING HOUSE REACH" PAYS-OFF!

More and more mining men are discovering that with the full 180° ground coverage of the G-900 Tracdril fewer moves are needed . . . that more blast holes can be drilled from every set-up.

In addition to the time-saving advantages of their 180° "Boarding House Reach", new G-900 Tracdrils have already gained an outstanding reputation for:

- Extra-long crawlers, 1350 sq. in. ground contact and knee-action . . . that take bad footing in stride.

- Remarkable ability to shift from straight verticals . . . to high horizontals, 11 feet at the face . . . or to snake holes at ground level.
- The time and step-saving advantages of two sets of grouped controls . . . one at turret, one at boom end.
- Heavy-duty brakes that lock and hold automatically the instant tramping throttle is released.
- You'll want a copy of Bulletin SP-3267 for G-900 specs, operating diagrams and dimensions. Write to:



Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

PORTABLE AIR COMPRESSORS • PNEUMATIC and ELECTRIC TOOLS
REICHDRILLS • THREE-CONE AIR-BLAST BITS • ROCK DRILLS

THE STRENGTH OF
A BELT IS IN
THE CARCASS!

and

Scandura
SOLID WOVEN PVC

has the highest tensile carcass
of any belting in the mining industry

Results:

- ✓ PROVED SERVICE RECORD!
- ✓ NO FASTENER PULL-THROUGH!
- ✓ LONGEST CENTERS!
- ✓ UNEQUALLED TOUGHNESS!

It's an easily-demonstrated fact: SCANDURA has the strongest, most densely-woven carcass of any solid-woven or ply-type belt. This superiority serves you best in *every* measure of belting performance—dollar by dollar, year by year! Your National Mine man has the facts. *Call him.*

550 feet per minute is normal for
SCANDURA on this rope conveyor

**National Mine
Service Company**



Koppers Building Pittsburgh 19, Pa.

DISTRIBUTING DIVISIONS:

ALABAMA DIVISION Birmingham, Ala.	ALL-STATE DIVISION Logan, W. Va.	ANTHRACITE DIVISION Mt. Carmel, Pa.
HEMECO DIVISION Beckley, W. Va.	KY.-VA. DIVISION Jenkins, Ky.	
WESTERN DIVISION Price, Utah	WESTERN KY. DIVISION Madisonville, Ky.	
MOUNTAINEER DIVISION Morgantown, W. Va.	WHITEMAN DIVISION Indiana, Pa.	

NEW SUPER-TOUGH ORE HAULER USES

N-A-XTRA

HIGH-STRENGTH STEEL TO CUT DEAD WEIGHT AND STRETCH PAYLOAD CAPACITY

This Lectra Haul M-55, made by Unit Rig and Equipment Co. of Tulsa, is now working in the open pit iron mines in Minnesota's Mesabi range. In bone-freezing -40° weather, it can stand up to the shuddering shock of 55 tons of drop-loaded iron ore, climb a 6% grade at 8.6 mph then dump those 55 tons in a crashing, grinding 18 seconds. The quarry body that takes this loading impact and dumping abrasion in sub-zero temperatures is made of N-A-XTRA high-strength steel, with X-A-R Abrasion Resistant Steel for extra hardness and toughness in wear areas. N-A-XTRA also forms the structural members of the complete unit.

Why N-A-XTRA? Because, pound for pound, it's nearly three times stronger than ordinary steel. That means it's strong enough to absorb severe punishment without constant maintenance, and light enough to handle the highest possible payload. In fact, the Lectra Haul payload is almost as much as the net vehicle weight itself.

N-A-XTRA and X-A-R are doing the job where only the strongest steels will do. Easily formed and welded, they are making products stronger, lighter, longer lasting. N-A-XTRA fully quenched and tempered steel is available in four levels of minimum yield strengths, from 80,000 to 110,000 psi. X-A-R steels are supplied in hardnesses from 360 to 400 BHN (or, by agreement, in a range between 265 and 500 Brinell). For full technical information, write Great Lakes Steel Corporation, Product Development, Dept. MCJ-1, P.O. Box 7310, Detroit 2, Michigan.



A PRODUCT OF

GREAT LAKES STEEL

Detroit 29, Michigan

N-A-XTRA AND X-A-R STEELS ARE AVAILABLE AT THESE STEEL SERVICE CENTERS

Benedict-Miller, Inc.
Lyndhurst, New Jersey

Joseph Demsey Co.
Cleveland, Ohio

Ducommun Metals & Supply Co.
Los Angeles, California

Interstate Steel Co.
Evanston, Illinois

Lockhart Iron & Steel Co.
Pittsburgh, Pennsylvania

Marsh Steel & Aluminum Co.
Kansas City, Missouri

O'Neal Steel, Inc.
Birmingham, Alabama

Salt Lake Hardware Co.
Salt Lake City, Utah

A. C. Leslie & Company, Ltd.
Montreal, Canada



Look for the STEELMARK
on the products you buy; place
it on the products you sell.

*Lectra Haul M-55; made by
Unit Rig and Equipment Co., Tulsa, Okla.
224,000 lbs. GVW
110,000 lbs. capacity
700-hp. diesel engine
4 wheel-mounted electric traction motors*

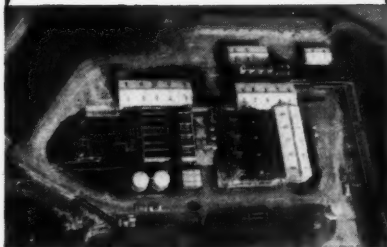
Design note: Bottom, sides and front of the Lectra Haul quarry body were fabricated of N-A-XTRA 100 (100,000 psi minimum yield strength) from plates $\frac{1}{2}$ " thick and reinforced with cold-formed channels of $\frac{3}{8}$ " thick N-A-XTRA 100. Wear areas of bottom, side and front slopes were made of X-A-R Abrasion Resistant Steel from plates $\frac{5}{8}$ " thick, 388 Brinell hardness. Fabrication followed standard shearing, gas cutting and welding procedures.

Great Lakes Steel is a Division of **NATIONAL STEEL CORPORATION**

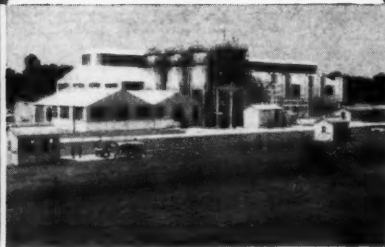
S U L P H U R

POINTS OF DEPARTURE

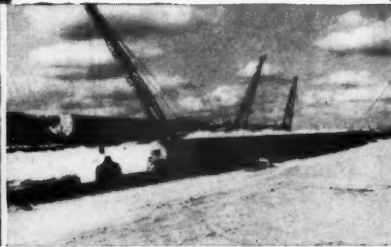
**FANNETT,
TEXAS**



**MOSS BLUFF,
TEXAS**



**NEWGULF,
TEXAS**



**SPINDLETOP,
TEXAS**



**WORLAND,
WYOMING**



**OKOTOKS,
ALBERTA**



Solid or Molten Sulphur to all users in the United States and Canada

In addition to these six producing properties, stocking and distribution centers are being set up, thus broadening the TGS Service to industry. Ample supplies of both molten and solid sulphur will be available at these centers. Cincinnati, the first of these units, is now in full operation.



TEXAS GULF SULPHUR COMPANY

75 East 45th St., New York 17, N. Y.
811 Rusk Ave., Houston 2, Texas

*Sulphur Producing Units: Newgulf, Texas • Spindletop, Texas • Moss Bluff, Texas •
Fannett, Texas • Worland, Wyoming • Okotoks, Alberta, Canada*

Editorials

MINING CONGRESS JOURNAL

April 1961

Finding the Answers

In the same way that "the shoe was lost for want of a nail," many an answer is missing for lack of a question.

There are many technical problems facing the coal mining industry that can be solved if only they are put in the right hands. At the same time, our engineering schools have a reservoir of technical know-how which in many cases is well qualified to tackle the problems in a particular field. The challenge, then, is to bring the two together.

The American Mining Congress has accepted this challenge and, through a newly organized committee within the framework of its Coal Division, has undertaken a program of "funneling" to engineering colleges suggested research projects in the field of coal production. The Committee on Coal Research will compile lists of suggested research problems recommended by the various Coal Division Committees, together with suggestions from others having knowledge of the industry's needs. The Research Committee will then function as a clearing house between the industry and the educational institutions, endeavoring to guide particular research problems into the hands of those having the talents and facilities to best seek their solution.

The goal, of course, is to see that more answers are found—by making known the questions.

More Federal Encroachment

The present Water Pollution Control Act, passed in 1948, is intended to encourage action by local, State and interstate agencies for the abatement of water pollution.

A proposal now under consideration by a House committee would, if enacted, negate the clear intent of the Act, and be a detriment to the cause of sound water pollution control.

The pending bill would extend Federal jurisdiction in this field—now limited to "interstate" waters—to all "navigable" waters. The United States Supreme Court has held that "navigable" waters include those upon which a log raft can be floated. In the light of such a precedent, it is readily apparent that the ultimate result of the proposed legislation would be complete Federal control of water pollution activities. This would relegate to little or no importance the highly successful work presently being accomplished by State and interstate agencies—and could lead to the development of a single national standard of water pollution control without recognition of local needs and conditions.

The legislation would also empower the Secretary of Health, Education and Welfare to issue pollution abatement orders, enforceable by Federal courts, based on his findings and conclusions following public hearings which he has conducted. The enactment of such a provision, coupled with a sharp curb on appeals from such orders, would write the totalitarian principle of Government as "judge, jury and policeman" into the law.

At recent hearings witness after witness, from mining and other industries, clearly showed that industry, States and municipalities have made solid progress in abating pollution of the Nation's waters, and will continue to do so if not hampered by further Federal encroachment into strictly local problems.

The mining industry is in complete accord with the need for sound water pollution abatement, and has effectively engaged in research and other activities to lessen pollution. It firmly believes, however, that the solution to water pollution problems can be much more effectively implemented if left in the hands of those familiar with local requirements, rather than by an all-encompassing Federal authority.

A Blow To Coal

The Nation's coal industry is concerned over a recent Government decision to permit a higher level of residual fuel oil imports into the Eastern Seaboard. Under the revised import control program, 168 million barrels will be permitted to enter through East Coast ports during the 12-month allocation period which began April 1. The total is 16 million barrels more than the quota for the preceding 12 months—an increase which is the equivalent of nearly 4 million tons of bituminous coal.

In addition, the Government announced that part of the allocation would be reserved to importers heretofore ineligible for import licenses. This change could lead to price-cutting maneuvers as new importers of residual oil compete for markets with the 32 previously established importers.

The mandatory oil import control program covers crude oil and refinery products as well as residual fuel oil. It was established early in 1959 after the Director of Civil and Defense Mobilization had determined that crude oil and some of its derivatives (including residual) were being imported in quantities that threatened to impair the national security by weakening the mobilization base. Under this program, annual imports of residual oil initially were limited to the level of these imports in 1957, or about 127 million barrels.

Since the program's inauguration, the Government from time to time has granted increased import allocations—with the result that the current 12-month ceiling for residual oil is about 33 percent higher than 1957 imports. At the same time, coal production lags 16 percent behind 1957. It's easy to see that the present level of residual oil imports puts many thousands of domestic workers out of employment—both in the mines and on the coal-carrying railroads.

In announcing the latest increase, Interior Secretary Udall stated that it would stimulate competition in the industry but would not change demand-levels. Therefore, he contended, it "will not be detrimental to the interests of other energy-supplying industries in the United States."

This question immediately arises: How long will residual fuel oil demand-levels remain unchanged under the stimulus of price cutting as the result of more abundant supplies for sale by a greater number of importers?

The answer seems obvious. The demand level will rise as prices drop—and the coal industry, highly competitive though it is, stands to lose more of its Eastern Seaboard markets to the residuary product of foreign oil refineries.

The industry's concern over the weakening of the import control program should be shared by everyone interested in the maintenance of an adequate coal mobilization base.

Preliminary Engineering and Water Control at Caland

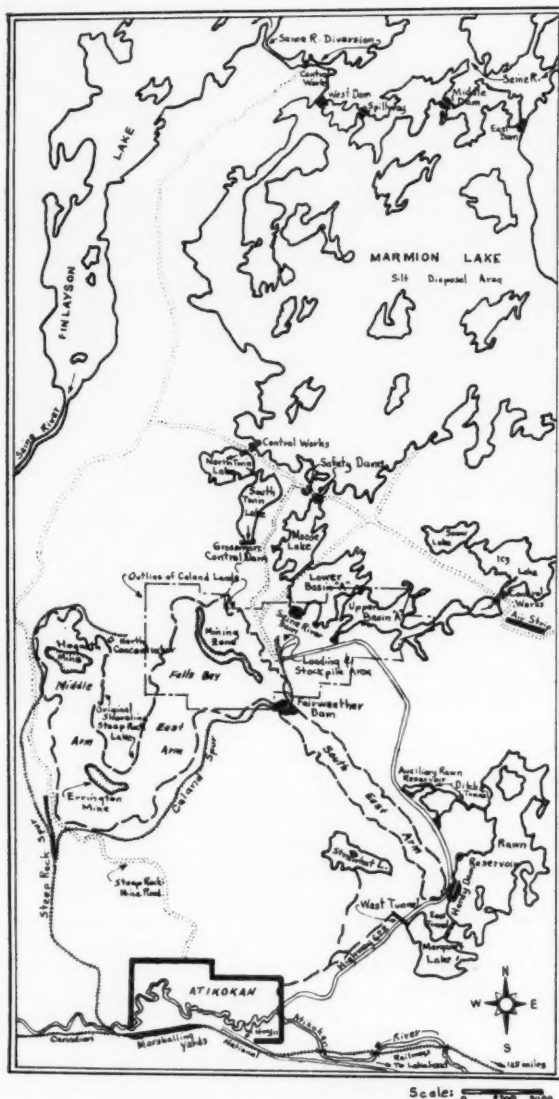



Fig. 1. Schematic map of the Caland project also showing location of the Hogarth and Errington underground mines of Steep Rock Iron Mines in the Middle Arm of Steep Rock Lake

By PETER P. RIBOTTO
Vice President
Caland Ore Co., Ltd.

In 1960 Inland Steel Co. began to receive its first shipments of iron ore from its Canadian subsidiary, Caland Ore Co., Ltd. This was the culmination of ten years of intensive planning and preparation, during which time close to \$60,-000,000 was expended in exploration, housing, dredging, roads, railroads, mine plant construction, and water control.

CALAND'S operation is situated at Falls Bay of Steep Rock Lake, five miles north of Atikokan, Ontario, and 140 miles west of the Lakehead cities of Port Arthur and Fort Williams. Steep Rock Iron Mines, from whom Caland leases over 1200 acres in the Falls Bay area, operates one large open pit, and is developing and mining two underground areas, all in the Middle Arm of Steep Rock Lake (figure 1).

Although some may feel that a mining enterprise in Canada has the advantage of vast areas in which to build, the fact is that most of the part of Canada occupied by Caland is standing on end. The topography is very rugged, overburden is thin, and exposed outcrops are numerous.



Dredging at Falls Bay of Steep Rock Lake was completed in October 1960. Fairweather Dam, shown in upper part of picture, is a 1200 ft long structure containing 515,000 cu yd of selected sand and gravel

The climate is not the least of nature's obstacles encountered at Steep Rock Lake. Although summers are generally pleasant, winter temperatures of lower than -60°F have been recorded and -40°F occurs frequently every winter. Snowfall is moderately heavy.

Early Work of Steep Rock Iron Mines

Presence of ore beneath the bed of Steep Rock Lake was suspected for many years, but it was actually not proved until 1938. Shortly afterward Steep Rock Iron Mines Ltd. was formed and began the gigantic task of liberating the ore from the lake bed.

Perhaps the outstanding feature of the entire undertaking is the diversion of the Seine River, which was accomplished by Steep Rock Iron Mines in 1944. The Seine, with a volume of as much as 15,000 cfs at flood stage, flowed through Steep

Rock Lake and from its headwaters to this point drained over 1800 sq mi. By an ingenious and costly diversion scheme, the river was re-routed through Raft and Finlayson Lakes to the north and thence west of the West Arm of Steep Rock Lake and back into the original Seine River channel.

At the time of the diversion Steep Rock Lake was at an elevation of 1263. As soon as the diversion was accomplished, a dewatering and dredging program was begun. The lake was lowered to 1120 elevation, at which point the high lake bed at the future site of the Errington mine permanently isolated Falls Bay from the rest of the lake. This was the status of Falls Bay when Caland entered upon the scene.

Steep Rock Iron Mines continued its dredging and dewatering operations and also began mining in 1944. Since that date they have shipped more than 20,000,000 tons of high grade iron ore.

Work of Caland Ore Co.

Caland Ore Co. Ltd., formed in 1949 as a wholly owned subsidiary of Inland Steel, signed a lease with Steep Rock Iron Mines in 1953. Among other things this lease required that Caland ship a minimum of 750,000 tons in 1960 and that this minimum gradually increase to 3,000,000 tons in 1969. Since the first production year has been successfully reached, it is apropos to look back over the myriad engineering projects which made this accomplishment possible.

During an option period prior to signing of the lease, Caland engaged in an intensive reconnaissance, mapping, and exploration program. The winters of 1950, 1951, and 1953 were devoted to diamond drill exploration from the frozen lake surface. This unique campaign at one stage involved more diamond drills than had ever been used on a single explo-



Grossman Dam, the only concrete dam among the many built by Caland, was designed to regulate the flow of recharge water entering the dredging basin, and also to divert run-off from a one sq mi catchment area northward into Marmion Lake

ration project. Drilling extended through over 100 ft of water and frequently as much as 400 ft of varved clay before bed rock was encountered. This program, which involved drilling over 250 holes, proved up sufficient ore to justify the large capital expenditure required to bring a mine into production.

During the summer periods of the early 50's, extensive field reconnaissance and mapping were done. A 52 sq-mi area was photographed from the air and maps were prepared covering large portions of this area. Of particular concern were the drainage controls which would be necessary for the proposed dredging program and to prevent inflow of run-off waters to Falls Bay after dredging and dewatering were completed. Preliminary schemes for these controls were devised at this early stage.

At this time concern was also shown for the safety of the old existing concrete dams above Falls Bay. These were formerly used by the Ontario Hydro Electric Power Commission in the generation of electric power. Steep Rock Iron Mines had planned for some time to construct an earth safety dam upstream from these structures and, with entry of Caland into the picture, agreed to proceed with construction forthwith. This dam was completed in 1951 and tested shortly afterward by lowering the water on the downstream side. Maintenance is now shared by the two companies.

Dredge Water Recirculated Ten Times

The Caland dredging project was completed in September 1960 with the removal of 162,000,000 cu yd of varved clay, silt, sand, and gravel. In connection with this, large areas had

to be isolated as disposal basins for the lake bed material. Controls had to be designed to permit recirculation of dredging water. Run-off water had to be regulated so that the lake level could be accurately controlled. Although removal of the water alone from Falls Bay seems a formidable task in itself, actually this water, totaling 20 billion gal. had to be recirculated about ten times as the transporting vehicle for the lake bed material.

A tremendous amount of engineering was required in order to obtain Licenses of Occupation from the government permitting the use of land and water areas for dredging and other projects. All arrangements with the government provide that when mining is completed most of these areas can be restored to their original use.

A vital part of the Caland project was to engineer and construct a seven-mile paved highway from Atikokan to the Falls Bay area. Construction was over rough country and cost close to a million dollars. All but 2½ miles of this road has been turned over to the Department of Highways of Ontario and is now maintained as a provincial road.

A five-mile railroad spur had to be constructed to connect with the railroad servicing Steep Rock Iron Mines. This spur was completed early in 1960.

Water Control—"Trademark" of Steep Rock Venture

The significance of the Seine River diversion has already been touched upon. Caland was faced with eliminating the inflow from an additional area of approximately 25 sq mi surrounding Falls Bay, and with controlling dredge discharge water so as to prevent discoloration of down-

stream waters. The potential seven-day flood from this area could amount to 1600 cfs or over 700,000 gpm!! (U.S.). Completion of all these controls will cost about \$4,000,000.

The company's water control projects have consisted of a thorough engineering evaluation of the problem followed by the design and construction of the control facilities. H. G. Acres & Co. Ltd. was responsible for the original hydraulic studies involved in the diversion of the Seine River. In 1953 Caland asked his company to make a study of the run-off problem in a 13½ sq mi area southeast of Falls Bay. In 1959 a similar study was completed on the remaining 10½ sq mi immediately surrounding Falls Bay.

The studies evaluated each area in terms of probable flood occurrences of intensities ranging from once in two years to once in 10,000 years, with an extrapolation to the maximum possible flood attainable. Use of this data is discussed under Southeast Arm Controls.

As has been mentioned, there are really two types of water control facilities at Caland: Those that provide for isolated silt disposal areas and for the recirculation of dredging water, and those that provide permanent elimination of run-off into Falls Bay. Of the latter type, the diversions are accomplished either by gravity or pumping. No attempt is made to separate these into any particular sequence since some of the schemes involve both gravity and pumping.

Marmion Lake Silt Disposal Basin

By the terms of the License of Occupation the company was required to isolate a settling basin in Marmion Lake covering an area of about 15 sq mi south of the Seine River. This was done with a series of three dams called West Marmion, Middle Marmion, and East Marmion Dams. These were all constructed in 1954 by end-dumping selected sand, gravel, and rock into the lake. Maximum depths of water were 60 ft.

The Middle and East Dams were constructed of selected sand and gravel obtained from borrow pits on adjacent islands. Equipment was transported to the construction site by barge. No special design features were involved in the Middle and East Dams since the maximum head expected is only 12 ft and no spillway required. Materials required came to 85,000 and 57,000 cu yd respectively for the two structures. The Middle Dam is 510 ft long and the East Dam

430, with maximum heights of 63 ft and 52 ft respectively. The top of each of the dams is at 1367 elevation.

A small concrete spillway, situated in a narrows between the West and Middle Dams, controls the lake at 1363 elevation. An impervious blanket of silty sand was end-dumped on the upstream side of all the dams and both sides are protected at the water level by rock rip-rap.

West Marmion Dam is a highly specialized type of structure designed to permit the passage of saw logs and pulpwood either through a sluiceway or over a 200-ft section of hinged flashboards. The dam is an earth fill structure except that it has a rock fill core and the flashboard section is erected on timber filled with rock. The dam is 690 ft long, has a maximum depth of 67 ft, and contains 83,000 cu yd of material.

The Marmion Dams have effectively prevented movement of silty water into the Seine River. It is expected that these structures will be breached when their function is no longer needed.

Recharge Facilities

In order to make the silt disposal basin effective, it was necessary to provide for recirculation of dredging water. In the first stage of the project this was accomplished by lowering North Twin Lake, cutting a channel between this lake and Marmion, and installing a control works to regulate the rate of recharge. This recharge flowed southward through North and South Twin Lakes and into Falls Bay just east of Lime Point.

In 1958 the North Twin Lake control was replaced by Grossman Dam at the south end of South Twin Lake. This structure, the only concrete dam among the many built by Caland, was designed to not only provide the recharge control during the dredging operation, but also to divert northward into Marmion Lake all the runoff in the Twin Lakes catchment area, comprising one sq mi. This arrangement also gives the added safety of two dams between Marmion Lake and Falls Bay.

Grossman Dam consists of 1240 cu yd of concrete, is 450 ft long, 25 ft high, and is designed for an operating head of 22 ft. Four Chapman sluice gates for recharge water control will be filled with concrete now that the dredging project is completed. Grossman Dam is now the focal point of a number of pipelines carrying pumped water from miscellaneous catchment areas in the im-

mediate northern periphery of Falls Bay and from the lake bed mining area.

When the recharge water first began flowing into Falls Bay, it was found to erode considerable sand and gravel just east of Lime Point and to wash it into the dredge pool. For this reason another small earth dam, East Lime Bay Dam, had to be constructed in 1957 to form a settling basin for gravel laden water. The dam contains 38,000 cu yd of sand and gravel, is 270 ft long, 45 ft high, and has a base width of 300 ft. It withstands a maximum head of 35 ft. Overflow from this dam entered a spillway tunnel and thence into a recharge pipe leading to the dredge pool.

Basin "A", which will be described later, formed an intermediate disposal area for coarser fractions of the dredged material. During periods of discharge into this basin, recharge took place either directly into Falls Bay via the old Seine River channel or else through the Twin Lakes route described above.

Southeast Arm Water Controls

The most involved, most expensive, and most unique of the water control facilities are those in the Southeast Arm area. This was the same 13½ sq mi area studied by Acres & Co. in 1953. The studies resulted in the formulation of a series of curves forecasting the probable run-off for various periods of time and for various flood intensities. On the basis of this and of detailed field studies by Caland engineers it was decided to construct two large earth dams, one at the entrance to the Southeast Arm—to be called Hardy Dam, and one at the outlet of the Southeast Arm—to be called Fairweather Dam. Both of these structures were designed on the

basis of an occurrence of better than a one in 10,000-year flood.

Hardy Dam is an earth-fill structure which, along with three rock tunnels and a partially dewatered Margaret Lake, diverts Hancock Creek and its catchment area of approximately 10 sq mi southward by gravity into the Atikokan River. This dam contains 410,000 cu yd of selected sand and gravel, is 1200 ft long, 70 ft high, has a base width of 570 ft, and withstands a maximum head of 68 ft. The upstream side, has a clay blanket with rock rip-rap.

Hardy Dam is constructed partially on a clay foundation which was thoroughly probed before filling began. The embankment was placed in one-ft lifts and rolled with a pneumatic, 60-ton roller. The structure was completed in 1956 and has been functioning exactly as predicted by the design criteria.

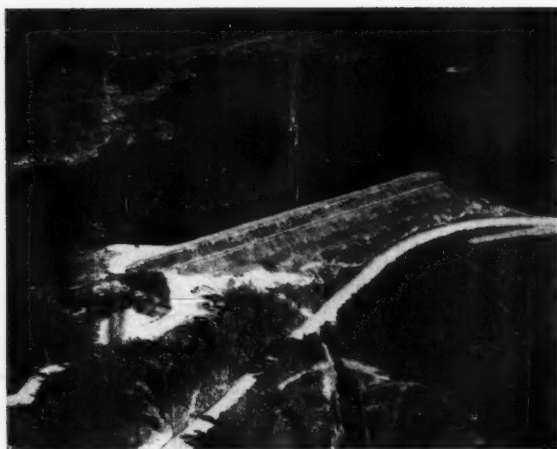
Fairweather Dam Built in Stages Over Three Years

Fairweather Dam is unique in that it had to be constructed in stages over a three-year period on a base of unstable material.

The proposed site for the dam contained varved clay up to depths of 80 ft. This material, similar to that encountered in the Falls Bay dredging, is extremely treacherous. At one moment it may stand safely in a 40-ft vertical bank, yet on the next instance it can practically liquefy. To remove all this clay from the dam foundation and backfill with suitable material would have been a task involving prohibitive costs. Yet to construct the dam directly on top of the clay by ordinary methods would almost certainly result in overloading and failure. R. M. Hardy, consultant in soil

When recharge water first began flowing into Falls Bay near Lime Point, it eroded and washed sand and gravel into the dredge pool. For this reason, East Lime Bay Dam was built to form a settling basin for the gravel laden water. Overflow from the dam was fed into the dredge pool by means of a spillway tunnel and recharge pipe





Twelve-hundred ft long, Hardy Dam is constructed partially on a clay foundation. The embankment was placed in one-ft lifts and rolled with a pneumatic, 60-ton roller

mechanics, was called in and, with the collaboration of Dr. Arthur Casagrande of Harvard University, a scheme was devised for building a dam in stages over a three-year period. The intervals of time would give the foundation clay an opportunity to consolidate under pressure and gain strength. The savings resulting from this novel adaptation of modern principles of soils mechanics amounted to many thousands of dollars.

A further unique feature of Fairweather Dam is that its top forms the roadbed for the Canadian National Railways spur to the Caland plant. The alignment of the dam, therefore, had to be controlled carefully so as to conform to the long sweeping curve of the railroad.

Devices for Observing Foundation Behavior

The first stage of construction, a 20-ft lift, was completed in 1955. With this first stage, piezometer tubes and settlement gauges were installed so that behavior of the foundation and of the hydraulic gradient could

be observed at all times. Similar gauges and tubes have been installed on all the more critical dams.

Subsequent carefully controlled lifts during the seasons of 1956 and 1957 brought the dam up to its maximum height of 90 ft. A surcharge of five ft was placed on the dam in 1957 and this was to have been removed in 1958. However, at the request of the Canadian National Railways because of grade problems, this was restudied in 1958 and it was determined that the surcharge did not have to be removed.

Fairweather Dam contains 515,500 cu yd of selected sand and gravel. It is 1200 ft long and has a base width of 900 ft. It will withstand a maximum head of 80 ft. Its catchment area is three sq mi and the flooded area is 0.4 sq mi. Into 1960 the water collecting behind the dam was drained into Falls Bay through a siphon. Upon completion of the dredging it became necessary to divert the water by pumping from a barge in Fairweather reservoir into a pipeline leading into Upper Basin "A" and thence into Marmion Lake.



Fairweather Dam, constructed on a base containing unstable varved clay, was built in stages over a three-year period. This gave the foundation clay an opportunity to consolidate under pressure and gain strength between stages. The dam now forms the roadbed for a rail spur to the Caland plant

Engineering records of settlement gauge and piezometer tube behavior will continue on structures like Fairweather Dam until the mining operation comes to an end. Consolidation of foundation material at Fairweather is proceeding as predicted and every indication is that the structure is perfectly stable.

Basin "A" Water Controls

The Basin "A" area lies northeast of Falls Bay and was originally laid out because of the importance of finding areas for the deposition of coarse materials from the dredging operation. It was later found possible for a higher area of Basin "A" to be isolated so that its drainage would proceed by gravity to Marmion Lake. Three intermediate earth dams were constructed in 1957 to divide the area into Upper and Lower Basins "A." These dams required 154,000 cu yd of sand and gravel. Upper Basin "A" was almost completely filled with dredged material early in the dredging program.

Lower Basin "A" was closed off as a separate basin in 1959 with the completion of the Seine River Dam along with its small auxiliary Mink Lake Dam, which contains only 15,000 cu yd of material.

The Seine River Dam was constructed in the old bed of the Seine River using 271,000 cu yd of materials. This earth-fill structure is 1100 ft long, 70 ft high, has a base width of 325 ft, and sustains a maximum head of 40 ft. A near catastrophe occurred shortly after this dam was completed. An old temporary dam just a few hundred feet downstream had to be breached to drain off some trapped water along with a quantity of re-deposited clay which had been discharged in this area during some of the early dredging.

When the breach was made a flow of liquefied clay got out of control and washed out a considerable area near the dredging contractors shops about one-half mile downstream. Much more serious was the fact that the rapid drawdown created slides on the downstream side of Seine River Dam. A complete collapse of the structure threatened, and this would have released millions of gallons of impounded water. Heavy equipment was quickly moved in to rebuild the damaged area and what might have been a disaster was averted.

Most of Lower Basin "A" has now been filled with dredged material. Water collecting in this basin is pumped to Upper Basin "A."

(continued on page 43)

Conventional Mining of a 28 To 36-In. Seam

By CLYDE H. STOREY

Director of Industrial Engineering
Princess Elkhorn Coal Division
Princess Coals, Inc.

How can a profit be maintained in coal that averages 30-in. in thickness?

THE Princess Elkhorn Coal Division of Princess Coals, Inc. produces approximately 5000 tpd from eight conventional loading units working in an average coal height of 30 in. At least four of these units employ partial belt haulage and all units are equipped with 24-in. high-capacity loaders, hydraulic self-propelled coal drills, 12RB cutting machines, and either widened 8-SC or 18-SC shuttle cars.

Importance of Height

A number of papers have been written on conventional mining in thin seams but very few have dealt with seam thicknesses less than 36 in. Therefore, it should be understood that in this article when reference is made to thin seams, the working height is between 28 and 36 in., primarily 30 in. This is of considerable importance because the thickness of a seam takes on progressively more importance as it decreases until the minimum height is reached.

The workable height is determined chiefly by the height dimension of the equipment but factors such as top conditions, realization and water must also be considered.

The ultimate aim of any mining operation is, of course, to maintain a reasonable profit margin and keep a desirable position in the competitive market, but achieving these goals can be far more complicated in low coal than in the thicker seams. To illus-

trate this the article will point out some of the little-realized problems of the above-mentioned conditions.

Cost Comparisons

For a given tonnage it costs more to pump water from a thin seam than it does to pump water from a seam of coal eight ft thick; more track, ties and feeder cable are required for a certain tonnage; a belt conveyor is no less expensive to install and maintain in the lower working heights; and it is easy to see that the same lengths of training cables are required for equipment whether the work is in a 30-in. seam or an eight-ft seam. Realization of the finished product should not be overlooked since an increase of \$0.01 in realization is just as good as a decrease of \$0.01 in actual mining costs. Therefore, on the domestic market where most of our coal is sold

it is important to sell as much block, egg and stoker sizes as possible and keep the minus $\frac{1}{4}$ -in. quantity to a minimum. But since the same size kerf must be cut by the cutting machine and approximately the same amount of powder and caps are used in 30 in. as are required in a much thicker seam, the percentage of fines increases almost in direct proportion as the coal height decreases.

Loaders Modified for Low Coal

How then can a profit be maintained in such heights as 30 in? To answer this let us first note that Princess Elkhorn's top conditions are generally good. The company encounters only a small amount of water in its workings, the bottom is of a variable nature but generally good, and the company has a very good position on the domestic market. However, these



The ultimate aim of any mining operation is to maintain a reasonable profit margin and keep a desirable position in the competitive market. These goals can be far more complicated in low coal than in the thicker seams



A worker on his knees when faced with sudden danger cannot move as quickly or as accurately as a man on his feet

relatively favorable conditions do not solve all the problems. If some particular area of difficulty seems to have no solution, then efforts must be made in some related area to achieve the same result of increased production and/or decreased cost. For example, let us consider one particular problem which was encountered and solved: With the very hard coal of the Elkhorn No. 3 seam, progressively more trouble developed with the company's old 14BU loading machines as the coal height decreased from 37 in. toward 28 in. because the reduced clearance over the conveyor pan would not allow large chunks to move over the loader. The coal is too hard to be broken by the force of the conveyor chain and would thus stall the machine until the loader could tram or maneuver into such a position as to permit large blocks to pass. One simple solution to the problem could have been to use more drill holes and more powder and caps to reduce the blocks to passable size. But this would have cost a considerable amount in extra powder and caps and would have reduced the realization of the finished product. Also, with an ever-decreasing coal height the loader itself would have encountered limiting height in a short time.

The problem was solved more economically and doors were opened to many new developments by rebuilding and redesigning the loading machines. In one extreme case maintenance personnel built a loader with a 15-in. coal line and an over-all height of 26 in. The loader was widened in order to effect the lower coal line. The

tread chains used for this loader were taken from an 11-BU loader and were installed so as to encircle the two 15-hp traction motors. Certainly this was a radical design and cost in the neighborhood of \$16,000, but it served the purpose and loaded coal as the company never thought possible in a 28-in. seam.

New Equipment Developed

Equipment manufacturers finally recognized the industry's needs in the field of low-vein equipment and began development of the present day high-capacity low-vein loaders such as Goodman's 964, Joy's 14BU-10, and Jeffrey's 81-C, to mention a few. Incidentally, the prototype models of the three mentioned were given their initial trials in our mines.

The 14BU-10 loaders of which the company has eight have a coal line of 14 in. and an over-all height of 24 in. The conveyor is 30 in. wide and the machine is capable of loading better than three tpm in 30-in. coal.¹

It is the development of these high-capacity low-vein loaders which solved a number of problems, but like any new method or means new problems arose. Some of the problems were serious, some not so serious; but by looking ahead management knew that the first problem would be over-capacity in the loading function of the face cycle and inadequate capacity in the preparation phase of the cycle, thus giving an unbalanced workload.

To accomplish a more balanced

¹ Three tpm is an average which considers all shuttle cars loaded in the course of a shift.

workload, the company increased the preparation potential by relieving the cutting machine helper of his duty by use of a hydraulic holding jack on the back of the 12-RB cutter. Hydraulic self-propelled coal drills were then obtained and the cutter helper transferred to the drill. These moves increased the preparation potential by about five places per shift.

Available Loading Time Important

As coal height decreases the reasons for the increased number of "places per shift" become more clearly defined. Assuming the same width and depth of a cut of coal, the tonnage produced from the cut is directly proportional to the height of the coal. As shown by the graph in figure 1, the higher the coal the more coal per cut and consequently the less places need to be loaded to produce equivalent tonnage.

This fact now leads to the importance of the available loading time. As the coal height decreases, the number of cuts needed to produce a given daily tonnage increase. If more places must be cleaned, then more time must be spent by the loader to maneuver and tram to the cuts. Also each shuttle car load is less and therefore more trips must be made by the cars to carry a given tonnage. Figure 2 is a graphical analysis of the decreasing available loading time with a decreasing coal height. The graph serves to indicate the limits of available loading time if applied to a fixed amount and type of loading and conveying equipment. The lower extremities of the curve appear to approach 0 percent loading time in the 27- to 28-in. range which is reasonable in view of the height of the equipment used for this study. There could be no loading time if the working height were 27 in. and any item in the list of loading and conveying equipment were 27.5 in. high. The upper extent of the curve indicates that with the present equipment the maximum loading time for this set of equipment is in the 50 to 60 percent range of the available face time. This is maximum available loading time regardless of the coal height if it exceeds 36 in. This is also reasonable since without some means of continuous haulage there would be a definite amount of time required for shuttle car change-out. Of course, if the cars were equipped with side boards to increase the capacity of each load, the curve would be shifted toward the left and upward. The same would also be true if face width were increased or if shuttle car haulage distances are shortened.

The practical value of this graph is to point out the importance of selecting the proper size equipment for the particular conditions of an operation. Of course, there will be a different curve for each set of equipment.

12 Tons Per Manshift

Through advanced mining techniques, time study analysis, and equipment development the company has been able to show an increased productivity each year for the past nine years. It is now producing approximately 12 tons per manshift, and in view of the decreasing coal height during this nine-year period, this certainly is to be considered a worthwhile achievement. Increased productivity is characteristic of the coal-mining industry and in general is the reason for our stable and competitive coal prices. The ever-present demand for higher productivity has spurred many of our contributions to the development of good low-vein equipment just as the sheer necessity for improvements has spurred some of the developments.

Shuttle Car Conveyor Widened

In the past year the company converted twelve 8-SC shuttle-cars into what it calls an 8-SC-2. The 8-SC was widened and lengthened to increase the capacity from 88 cu ft to 120 cu ft which in 30-in coal means an added tonnage capacity of approximately one ton. This change allows the company to use only two shuttle cars instead of three on each section. The advantages of two wide cars over three smaller cars are readily seen in the facts that one less driver is required per unit shift, one less trailing cable reduces the cable cost, four less wheel units, four less motors, etc., reduce the number of spare parts required for replacement. Also, the advantage of having fewer units to maintain allows the maintenance personnel more time to devote to maintenance of other sectional equipment.

In widening the 8-SC's the conveyor was widened from 44 in. to 59 in., an increase of 15 in. while the over-all car width was increased only 7.5 in. This was achieved in the company's central shop by moving the conveyor motor to the operator side forward of the pump motor, housing the cable reel where the conveyor motor originally was located and flattening out the controller box by changing the resistance location. To facilitate this arrangement the boom was lengthened 7.5 in.

The benefits of the widened 8-SC

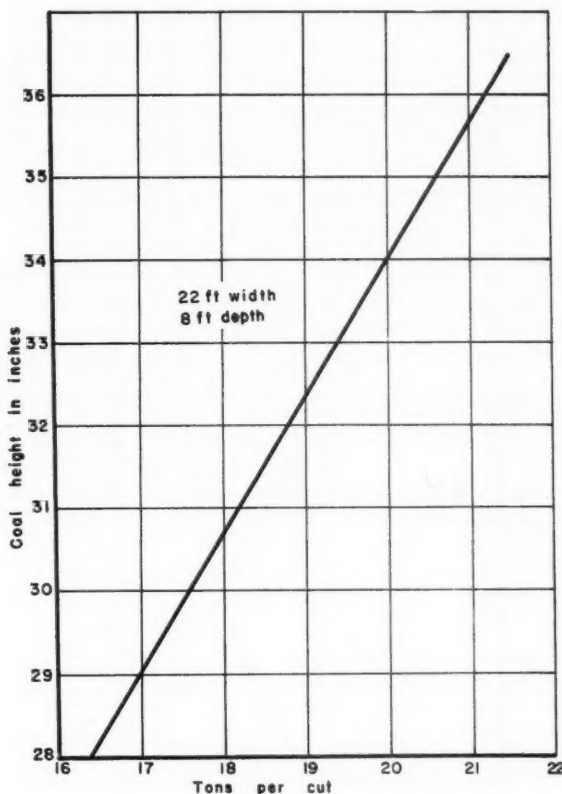


Fig. 1. Assuming the same width and depth of a cut of coal, the tonnage produced from the cut is directly proportional to the height of the coal

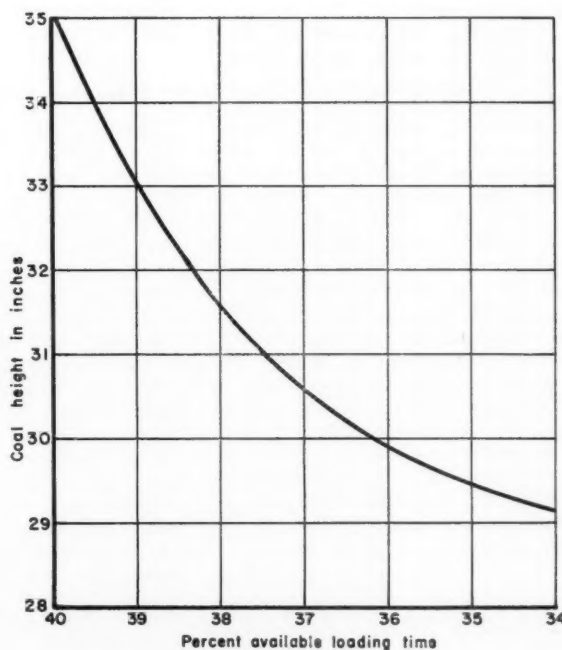
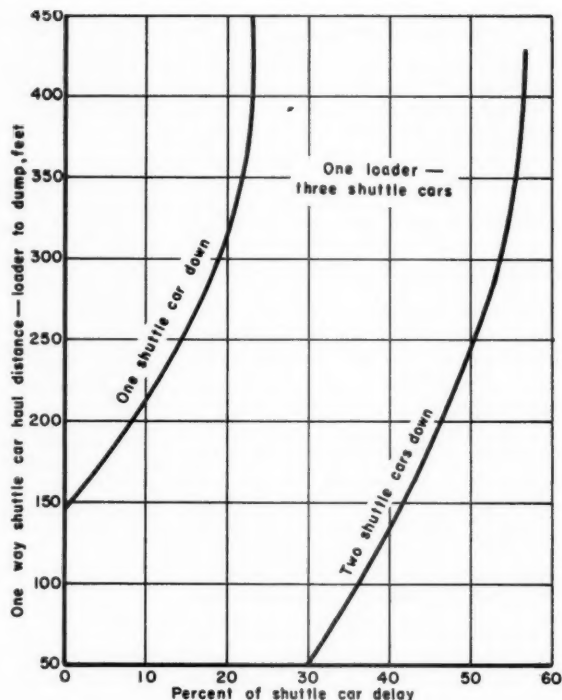
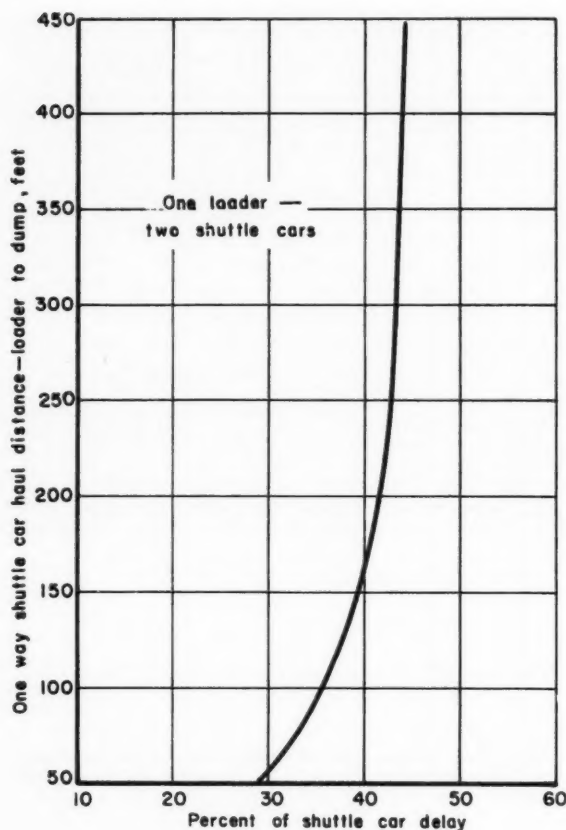


Fig. 2. Available loading time varies with the height of the coal seam for a fixed amount and type of loading and conveying equipment



Figs. 3 and 4. Production from a section using three normal width cars is affected much less as a result of a shuttle car delay than is the production from a section using only two cars. The above graphs were constructed from time study data and represent the actual loader delay as the result of shuttle car delays for any given haulage distance

most certainly justify the action of widening the car, but it is also important to point out some of the deterring factors which go along with the improvement.

Production from a section using three normal width cars is affected much less as a result of a shuttle car delay than is the production from a section using only two cars. For instance, let us assume one car on a three-car section is delayed for one hour. The actual lost loading time as a consequence of the delay is only five minutes if the shuttle car haul distance is 200 ft. But if there are only two cars on the section and one is delayed for one hour, the actual lost loading time amounts to 25 minutes, assuming the haulage distance is comparable.² Lost loading time is 8.5 percent and 42 percent respectively of the 60-minute shuttle car delay which conforms to the graphs in figures 3 and 4. These graphs were constructed from time study data and represent the actual loader delay as

the result of shuttle car delays for any given one-way haulage distance.

However, some of this disadvantage is offset due to the fact that with only two cars there is less possibility of shuttle car malfunction.

Three Major Reasons for Delays

Delays at the face affect all mining operations to a great extent and low coal mining is no exception. In fact, low coal operators are plagued by delays more than high coal operators in most cases. This is because of a number of factors, but the three major reasons are: (1) less clearance over the equipment means less air circulation which restricts dissipation of heat from motors and causes more frequent failures, (2) since workings advance much faster, trailing cables receive much more punishment and also these cables cannot be hung along the roof but they must lie on the bottom where they are damaged by water and moving equipment, and (3) since more trips are required by shuttle cars and more tramming is done by the loader and cutter to clean and cut more places, there is more wear on parts.

Projected Life

It is significant to note that since workings advance more rapidly in low coal the available face time decreases more rapidly. Man-trip time consumes such a large portion of each shift that serious thought should be given to the expected life of a mine. When planning development of a new area, it is important to predict at what time in the future the portal facilities will have to be moved up. This move will come much sooner in a seam 30 in. thick than in a seam four ft thick. Small truck mines do not have this problem to consider nor do they have to cope with substations, feeder wire, main line haulage tracks, etc.

The projected life of a mine is also more important in those lower heights because with present day labor seniority agreements, the age of the laboring force is more critical. In coal seams high enough for men to walk, age of the workers generally does not affect production until the last few years before retirement. But in seams where workers are forced to crawl, the working efficiency drops off considerably after age 50, gen-

² Graphs prepared for Anaconda Wire and Cable Co., by Coal Std., Inc. "The Cost of Mining Cable Delays and a Method of Calculating These Costs."

erally speaking. Therefore, when opening a new mine if the average age of the laboring force is 30-35 years, there is a good chance that production will be seriously affected after 15-20 years' operation as the percentage of men over 50 begins to increase rapidly.

Proud of Safety Record

Accident prevention in coal mining has certainly come a long way in the past decade, and has contributed much to reduced cost and higher productivity. Princess Elkhorn's safety record is as impressive as some of the high coal producers and is a fact in which the company takes pride since it should be remembered that more man-hours are required to produce a given tonnage in the lower seams. Too, the width and length of equipment has been pushed to the limit since more capacity cannot be obtained in the height dimension, thus affecting maneuverability of equipment.

A worker on his knees when faced with sudden danger cannot move as quickly or as accurately as a man on his feet. However, knowing the hazards of low coal operation the workers are aware of the fact that operators of equipment cannot be expected to see all that is happening around them due to the lack of clearance and therefore plenty of room for safety is allowed when passing or approaching equipment.

Preventive Maintenance

Preventive maintenance at Princess has been essential to the continued success of its operations. The program involves considerable detail and was adequately covered by Walter Grace, superintendent of maintenance, in the August 1959 issue of *Mining Congress Journal*. It is based on a change-out schedule which is constantly revised to reflect the needs of the changing conditions and circumstances.

As Applied to Thicker Seams

The writer's feeling in comparing low coal operation with high coal operation is that any maneuver or new method which can be construed as profitable for low coal miners should in most cases be profitably applied in the thicker seams. We all have the common aim of producing the most possible coal by the least expensive means and by the safest possible methods. Whatever saves money in low coal should also save money in high coal.

PRELIMINARY ENGINEERING (continued from page 38)

Miscellaneous Water Control Facilities

Several small water control facilities have been constructed at places such as Pete Lake and Pal Lake on the south shore of Falls Bay. In these areas not much more was needed than for a bulldozer to construct a small earth dam at the outlet of the lake. A small channel carried the run-off to a new watershed. Yardages of material were insignificant.

Several highway fills on the Caland Highway were designed as dams to withhold the reservoir behind Hardy Dam.

Two dams were constructed above West Lime Bay during the summer of 1960. These will act as reservoirs from which water will be conveyed by pipeline to the Twin Lakes catchment area. These West Lime Bay Dams, as they are called, involve a yardage of 30,000 cu yd of material.

Sumps will have to be created in the mining zones to capture local run-off water from whence it will be pumped to the various reservoirs. One such sump was created in a silt barrier during the dredging and now forms part of the lake bed water control system.

As time goes on some control facilities may be needed to divert the water which now comes through a fairly large catchment area and erodes the slopes of the East Arm. In addition, waste rock from the mining operation will be used to rip-rap these slopes.

Water Diversion by Pumping

The summer of 1960 saw the installation of a complex pumping scheme which will divert the water

from all those areas where gravity drainage is not feasible. The basis for these installations was a detailed study which not only considered all flood possibilities, but also related this to reservoir and pumping capacities and to the damage that a flood could do to mine installation. A tabulation of this comprehensive study enabled management to select, almost at a glance, the most feasible and economical plan. The plan is based on a one-in-20-year flood.

The entire pumping scheme consists of the following:

- (1) Water is pumped from several sumps in the mining zone to the Twin Lakes catchment area.
- (2) Water is pumped from the West Lime Bay Dams to the Twin Lakes catchment area.
- (3) Water is pumped from Fairweather Dam to Upper Basin "A."
- (4) Sometime in the future a reservoir may be created in the East Arm from whence water will be pumped behind Fairweather Dam.

The existing scheme encompassed by items (1) to (3) consists of ten pumps in five installations with capacities ranging from a 2200 gpm unit up to a 60,000 gpm pump which was formerly part of the dredging plant.

With the dredging completed and the water control facilities in operation, Caland is in a position to continue full scale iron ore production. Open pit mining continues and some underground mining will start in a few years. There is every confidence that the intensive engineering and complex installations will pay off in improved mining conditions and lower mining costs.



Loggers in the vicinity of Marmion Lake must be able to float their logs and pulpwood into the Seine River. Taking this into account, West Marmion Dam was designed to permit passage of logs through either a sluiceway or a 200-ft section of hinged flashboard.

HERE IS THE JEFFREY 100-L MINER

SEE IT AT THE COAL SHOW



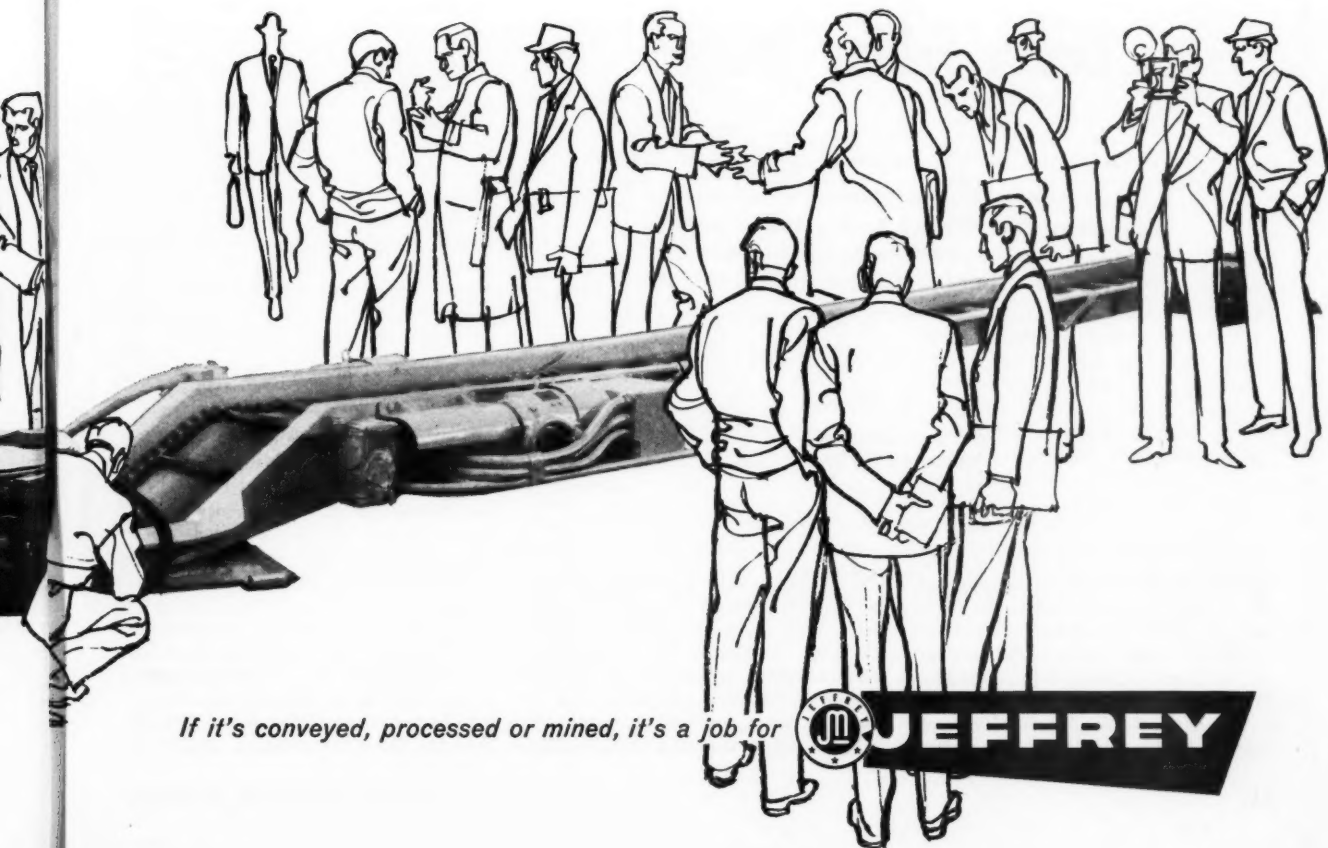
LEARN HOW Jeffrey's quality now comes in a continuous miner only 20½" high.

LEARN HOW maximum production can be obtained in a new, low-cost way.

LEARN HOW Jeffrey's new Model 100-L Miner works with a Jeffrey 94-L Bridge Conveyor with only a four-man crew.

LEARN HOW operating costs have been slashed by this new design.

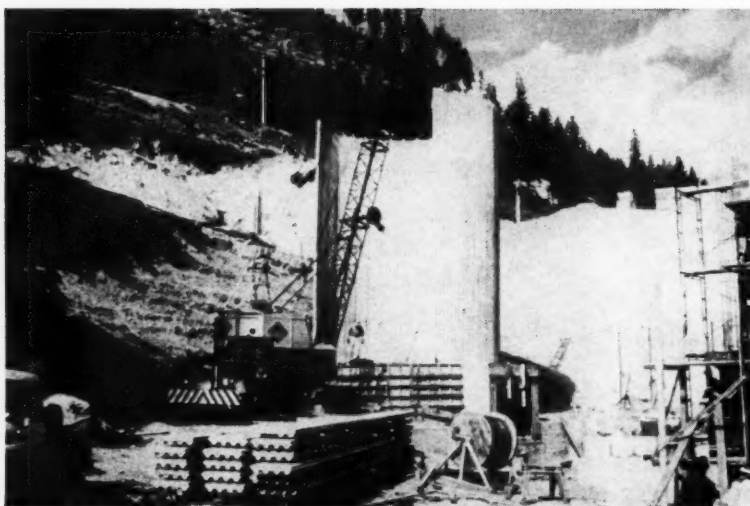
SEE IT AT THE SHOW. JEFFREY'S NEW MINER WILL BE IN OPERATION THERE. COMPLETE INFORMATION AVAILABLE AT BOOTH 2855, or write The Jeffrey Manufacturing Company, 958 North Fourth Street, Columbus 16, Ohio.



If it's conveyed, processed or mined, it's a job for



JEFFREY



Two 1000-ton capacity ore bins were erected in two days at a cost of about \$5000 each. Loops of one-half in. cables stressed at about 10,000 lb hold the bins together. Shown is the fine ore bin two-thirds complete

New Mill and Surface Plant of the Lucky Friday Mine

An account of how a relatively small mining company can come up with a well-designed, easily-operated, modern and efficient plant erected in record time at a minimum cost

By J. G. CRAIG
Mill Superintendent
Hecla Mining Co.

THE Lucky Friday's property is located just north of U. S. Highway 10, about a mile east of the town of Mullan, Idaho. It is in the east end of the Coeur d'Alene mining district in the northern part of the State.

The property consists of four patented claims and two unpatented

claims. The claims in the group were located between 1899 and 1906, and the Lucky Friday Co. was organized in 1906. At that time considerable surface trenching and some shallow underground work was done with no success. The property was sold in 1912 for \$2000 to satisfy labor claims.

Present Company Organized in 1939

Another firm, the Lucky Friday Mining Company, bought the claims in 1914 and spent 12 years driving what is known as the tunnel level crosscut. Very little ore was found, work was discontinued, and taxes went delinquent for nine years.

In 1939 John Sekulic, a Mullan service station operator, became interested in the mine and took a lease on the property with a \$15,000 purchase option. He reopened the crosscut level and explored a narrow vein with little success. At this time he tried to get other larger companies in the district interested in taking over his lease. Failing at this, in 1939 he organized the present company, the Lucky Friday Silver-Lead Mines Co., and sold enough stock to start sinking a shaft. Still no commercial ore was found and stock was offered at pennies a share to help finance deeper work. When this money was gone, more was borrowed from various sources to continue sinking the shaft. Some miners at this time worked at the rate of 100 shares per shift to continue the exploration work.

Only \$78,270 in cash was raised during this entire time to finance exploration and development of the property to its productive stage through issues of approximately 690,000 shares of stock. The average price received in cash for materials and services was 11.4 cents per share. Although this was the only money ever raised, some of the original officers readily admit that considerable equipment was "begged, borrowed and stolen" to continue exploration. Then in 1940, at the 300-ft level a small shoot of commercial ore was found. Since then the mine has been continually in ore and in steady operation. The ore was milled nearby in a custom mill at a rate that increased to about 200 tpd in recent years.

New Mill Cost About \$1000 Per Ton Day

Late in 1958 the Hecla Mining Co. became interested in the Lucky Friday, and by January 1959, had purchased about 38 percent of the stock. Hecla then proceeded with plans for construction of a new mill and surface plant located at the property.

All the design work, engineering, drafting and purchasing was done by the Hecla staff. The construction crew was recruited locally and the dozer and heavy crane lifting work was all done by local contractors. Much of

the equipment for the mill was used, and, although reconditioned, this tended to complicate the design problem. Original plans were to erect a 400-tpd mill, with a capacity of 500 tpd, which could readily be expanded to 700 tpd and which ultimately might handle 1000 tpd. This also tended to complicate the design.

Actual construction got under way in May 1959 under the direction of Wray Featherstone as construction superintendent and Toivo Kangas as construction foreman. During the peak of construction about 55 men were employed. The mill was completed and put into operation on February 8, 1960. This mill was erected in less than nine months for less than \$1000 per ton day.

Factors Behind Nominal Cost

Some of the reasons why this mill could be constructed by a relatively inexperienced crew at this nominal figure are listed below. By inexperienced crew is meant that most of the men that worked on this job had never been around mill construction before.

1. Design and flow sheet were kept as simple as possible within the limits of desired results.
2. Topnotch supervision and good men on the construction crew.
3. A good hard-working crew that had high morale and pride in its work. Part of this was due to good pay.
4. Very little overhead.
5. Small, hard-working design drafting and engineering crew—generally only two men.
6. Good local experience guiding us in design problems.
7. Not hampered with labor jurisdictional difficulties. Most men worked on any type job they were capable of handling.
8. Much of the equipment was used but in good condition.
9. Good supply and shop facilities available locally.

This article does not cover the details of the milling process, but rather some of the newer and different features of construction and operation.

Stave bin construction—The two reinforced concrete ore storage bins were erected in about two days each at a price slightly over \$5000 each. They are cylindrical bins 24 ft diam by 35 ft high and consist of staves 2 ft wide by 35 ft long with an average thickness of 4 in. and 6 in. These staves are held together by a number of loops of ½-in. cable stressed at about 10,000 lb each. This construction may be likened to a wooden barrel with staves held together by steel bands. The capacity of each bin is



The fact that much of the equipment in the mill is used tended to complicate the design problems

about 1000 tons total with about 500 to 600 tons available. No freezing difficulties have been encountered to date.

Utility culvert—An Armco culvert five ft in diameter contains all the utility lines running between the mill and the surface plant. It contains steam, water, air instrument lines, power and sandfill lines. It also serves as a conduit for warm air between the mill and the crushing plant. It has the advantage of making these lines readily accessible throughout their entire length.

Wooden beams—The main mill building roof is supported by laminated wooden beams. These beams are 9 in. wide, 36 in. thick at the center, 26 in. thick at the ends, and 54 ft long, with a 50-ft span. They had the following advantages over steel, which, by the way, was difficult to obtain because much of the ordering was going on at the height of the steel strike.

- a. Better fire insurance rate.
- b. Easier and less expensive to install than steel.
- c. Less weight per equivalent strength.

Modern surface plant—The surface plant is conveniently laid out, attractive, and with ample room. It contains a transformer station, compressor building, change house, office, engineering, accounting, warehouse and shop.

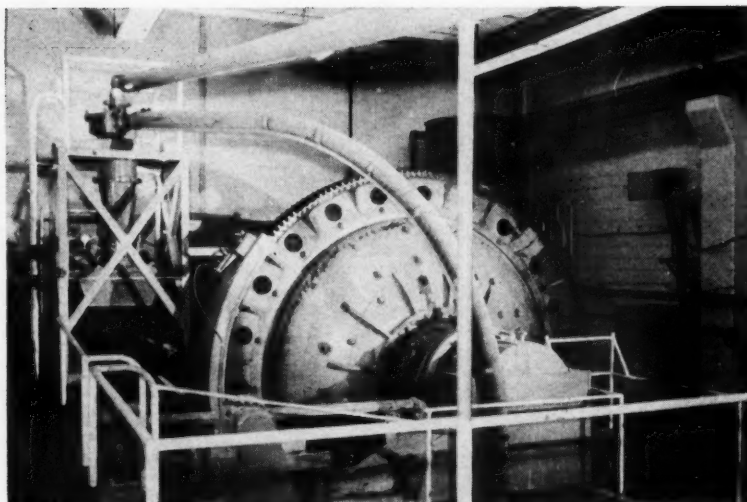
Mine ore conveyor (remote operated)—Ore is conveyed from the mine to the mill coarse ore storage bin

on a 30-inch wide 600-ft conveyor belt. This belt, located approximately 1000 ft from the main mill operating area can be controlled remotely from this point. The operator can start and stop the belt and control the chute openings from the main mill area. He also obtains the tonnage record in the mill and can watch the loading station on a television set at the mill area. This belt, capable of handling about 400 tph, also transfers waste from the mine to outside storage. Feeders, gates, chutes and belts are all electrically interlocked so there is no possibility of running ore into the waste or vice versa.

Grinding section feed control—Pre-set, predetermined ore tonnage is held constant with a Marquardt Cono-weigh pneumatic control circuit, where the speed of the ore feeder is automatically adjusted to a pre-set weight on the belt scale.

Grinding section water control—All water fed to the mill is fed through rotameters using ordinary gate valves for control. The rotameters require constant head feed and a clean water supply. By their use, the operator is aware at all times of the quantity of water going to each section of the ball mill circuit. This close water control, combined with controlled feed, results in very constant density in the flotation feed.

Reagent control—All reagents—copper sulphate, amyl alcohol, zinc sulphate and zanthate—are fed through small, direct-reading rotameters. Again to make these rotameters operate constantly, a constant head



Minus 1/4-in. mill discharge is pumped to a hydrocyclone from which underflow is returned to the mill and overflow goes to the lead flotation circuit

is required, relatively clean fluid is desirable, and some method of adjustment is necessary. Small stainless steel needle valves are used for shut-off and pinch cocks for adjustment.

This system has the following advantages:

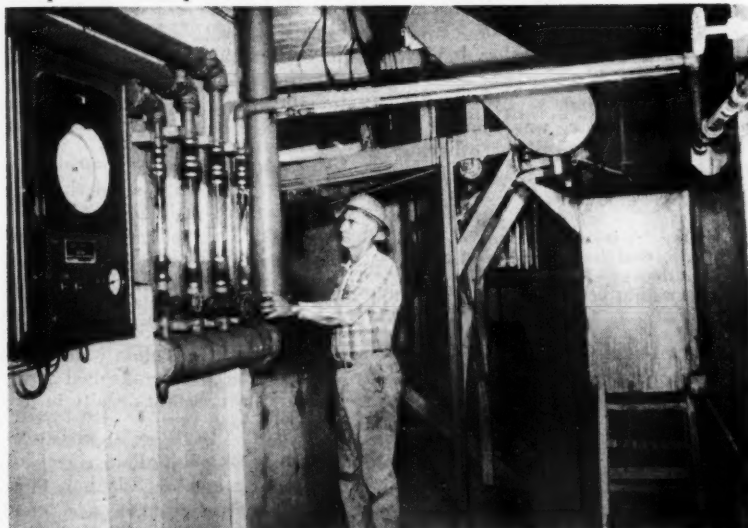
- a. Easy to adjust and control.
- b. Readily visible for constant checking.
- c. It is a clean, neat and safe reagent system.

Cyclone classification in primary grinding circuit—The mill discharge is screened on a two-ft by six-ft vibrating screen divided into two sections. One-half the screen is covered with 1/4-in. square mesh cloth, and the other half is covered with one-in. square mesh cloth. The minus 1/4 in. dumps into a sump from which it is

pumped to a 15-in. Krebs cyclone.

Cyclone underflow returns to the mill feed scoop and overflow flows by gravity to the lead flotation circuit. The plus 1/4-in. minus 1-in. material feeds on a 12-in. conveyor belt back to the mill feed scoop. The plus one-in. material, (mostly wood chips) dumps into a trash box and is collected and burned periodically. This type of classification is found to have the following advantages:

- a. Simple to operate.
- b. Good constant results are obtained. The system is able to absorb minor changes in the circuit—changes such as fine to coarse ore, changes in moisture in the ore and minor tonnage changes—and is still able to produce relatively constant grinds in the cyclone overflow.



Water in the grinding circuit is controlled with ordinary gate valves used in conjunction with rotameters. The operator is shown at the grinding section control panel where he is adjusting a valve

- c. Very little maintenance in the system. Pump parts (impellers and case liners) wear out in about four months (about 50,000 tons of new feed). The cyclone rubber-lined parts last about a year, or about 130,000 tons of new feed.

Sandfill—The horizontal cut-and-fill mine stopes are backfilled with classified mill tailings. Mill tailings are pumped with a four-in. Hydro-seal pump to two 10-in. cyclones, with cyclone underflow flowing to a rock storage tank that holds about 120 tons of sand at about 60 percent solids. The cyclone overflow is piped to waste via the tailings line.

The sand flows from the storage tank down the shaft into the stopes by gravity. The stopes are filled at the rate of about 40 tons an hour, so it takes about two to three hours to fill an average stope. After filling, about six hours are required for drainage before the men can return to the stope and start mining. The whole system is remotely operated from the stope; that is, the sand man can start and stop the flow of sand from the storage tank, add flush water and add blow-out air as necessary directly from the stope. This sandfill system has the following advantages at the Lucky Friday mine:

- a. Tighter fill is obtained and the walls hold better; therefore, less dilution of waste in the ore.
- b. Less handling or waste fill material.
- c. Much faster.
- d. Very much cheaper than conventional methods of filling with waste ore (about 40 cents per ton vs. about \$2.50 per ton of the extracted ore).

One of the major advantages of a company building its own mill is that many of the operating problems and bottlenecks can be solved as construction progresses. The mill was scheduled to start on February 1 but it actually got on stream on a 24-hour basis on February 8, 1960. We had a short shakedown period and encountered few troubles in the early operation of the mill. Daily tonnage was gradually increased throughout the year from about 450 tpd during the first few weeks to about 650 tpd by the end of the year. Metallurgical results were quite good for the year, averaging over 98 percent recovery for both lead and silver in the lead concentrates.

We are justifiably proud of this mill and the men who played a part in its construction. It is a good place to work, it is clean, it is safe and it is efficient.



NOW! Westfalia Coal Planer For Thick Or Thin Seams, Full Roof Control . . . True Continuous Mining!

The Latest Installation in West Virginia Is Operating Successfully
After More Than Six Months' Continuous Production

The Westfalia Coal Planer, the only *truly* continuous miner, with new Westfalia self-advancing, hydraulic roof supports and the ability to operate in thick or thin seams, will cut costs while increasing production. The Westfalia system is fully adaptable to room and pillar mines.

You reduce costs because the durable Westfalia Coal Planer lowers maintenance and repair expenses, requires no other roof supports or bolting and is operated by a minimum crew. You eliminate cutting, drilling, explosives and all other loading equipment.

Production goes up because you extract all the coal across a working face which may extend up to

800 feet or more. Production is continuous since the Westfalia planer, conveyor and self-advancing roof supports press continually against the face. Burnt or sticking top coal is removed by the planer automatically.

The Westfalia System, first brought to this country through the cooperation of the U.S. Bureau of Mines and a coal producing company, has proved itself in several hundred installations in all important coal mining areas of the world.

Use coupon below, clipped to your letterhead, for further information. Consultation on engineering or equipment problems is readily available from our technical personnel at no obligation.



Visit our exhibit at the AMC Coal Show
Booths 125, 129, 133 and 137

Mining Progress, Inc.

Sole Distributors for Westfalia Lünen
HIGHLAND MILLS, N. Y.

Mining Progress, Inc.
Highland Mills, N.Y.

I'd like to know more about the Westfalia System, the coal planer, conveyor and new hydraulic roof supports and how it can reduce costs while increasing production in thick or thin seams.

Name

Title

Company

Address

THE 1961 AMC COAL SHOW



COAL SHOW / MAY 15-18

*There is no other place in the world where mining men can
learn so much about the latest developments*

*in mining methods and equipment in such a short period of
time. This special preview section has been*

*prepared to help in planning a Coal Show visit
that will pay maximum dividends*

Cleveland, Ohio, will have the red carpet out May 15-18 for the thousands of mining men and their ladies who will converge on the city from across the Nation and around the world to attend the industry's biggest meeting of the year—the 1961 Coal Show of the American Mining Congress. Focal point of Show activities will be the Public Auditorium, scene of both the convention sessions and the record-breaking mining machinery exposition.

The coal industry is out to strengthen its competitive position in the energy market. To do this it must take full advantage of all new operating techniques and equipment that will increase efficiency, promote safety and reduce costs. Hence the importance of taking a “refresher” course in modern coal technology—by attending the 1961 Coal Show. Nowhere else can mining men find the answers to so many of their problems in such a short time as at this great Convention and Exposition, where the emphasis is on progress.

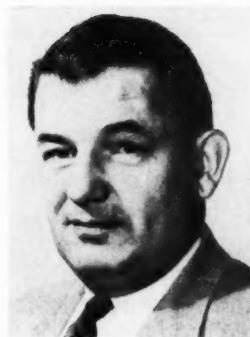
The National Program Committee, headed by F. S. “Stilly” Elfred, chairman of the board, Peabody Coal Co., has scheduled a comprehensive and well balanced program which has attracted world-wide attention. The sessions will include talks on National Fuels Policy, the Office of Coal Research, and coal's near-term future, as well as on underground and strip mining, management and cost controls, safety, and coal preparation. As always, those in the audience will be invited to participate by asking questions and contributing their views.

Men from the fields of metal mining and industrial minerals will also discover a lot of “bread-and-butter” ideas at the Coal Show. In addition to the exposition, which features a wide variety of machinery and equipment having direct application in their operations, there will be a special session on “Cost Cutting Developments—Open Pit Mining” devoted to successful maintenance programs, improved blasting methods and cost-cutting through operations research.

MORE THAN 240 EXHIBITORS

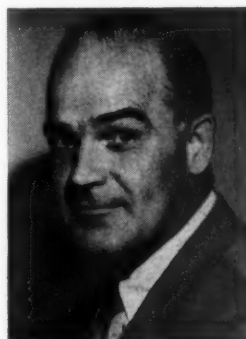
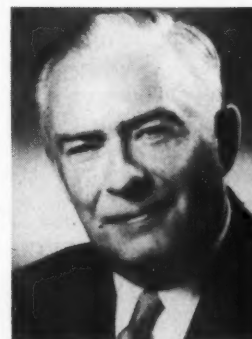
Everything from blasting caps to mammoth coal haulers will be on display at the Coal Show. More than 240 exhibitors have pulled out all stops in their efforts to make this Exposition one that will be long remembered. Most of the exhibits will feature full-size machinery and equipment, while others will use operating scale models,

Raymond E. Salvati
President, Island Creek Coal Co.
President, American Mining
Congress



Jesse F. Core
Vice President—Operations—Coal
U. S. Steel Corp.
Chairman, Coal Division

F. Stillman Elfred
Chairman of the Board
Peabody Coal Company
Chairman, Program Committee



D. E. Davidson
Vice President for Sales
Link-Belt Co.
Chairman, Manufacturers Division

cutaways or action displays to emphasize certain operating features. Many of the units to be shown will be introduced to the industry for the first time. The exhibit descriptions on pages 59 to 68 give a hint of what is in store for Coal Show visitors.

All exhibits will be staffed by able men, prepared to discuss and demonstrate the latest proven machinery and methods and their application under various conditions. Two half-days are being left entirely free of other activity, to allow plenty of time for studying the displays and conferring with the manufacturers' representatives. These men will be glad to discuss specific operating problems as well as furnish full information on their equipment.

COAL MINERS PARTY ON WEDNESDAY

On the lighter side there will be the Coal Miners Party on Wednesday—the only “official” evening entertainment event of Coal Show week. Always the talk of the Convention, the party will again be held at three hotels, each featuring the same superb dinner menu. Good music, dancing, and a lively floor show will insure fun for all.

Monday, Tuesday and Thursday evenings will be left free for the many parties that are being scheduled by individuals and companies, and for visiting with old friends and making new ones. Also, Cleveland has many fine eating places, entertainment and scenic attractions, and many convention-goers will want to spend some time “taking in” the city.

THREE SPECIAL LADIES EVENTS

A special invitation is extended to the ladies to visit the Coal Show Exhibits and attend the Convention sessions. In addition, they will have their own special program. At a Welcoming Luncheon on Monday, Mrs. Ivy Baker Priest, former Treasurer of the United States, will discuss the Washington scene and give her views on “Women in Government.” On Tuesday the ladies will visit General Electric's famous Lighting Institute at Nela Park for a fascinating demonstration of future lighting trends, following which they will be given a conducted tour of the May Show at the Cleveland Museum of Art. Wednesday

has been reserved for luncheon at the Shaker Heights Country Club, with a novel presentation by Marthie Bouche of New Orleans, the “Madhatter,” showing how to select a hat to fit the wearer's personality.

Ladies Headquarters will be on the Mezzanine Floor of the Sheraton-Cleveland Hotel, beginning 10 A.M. Sunday.

TWO FIELD TRIPS OF SPECIAL INTEREST

Two interesting field trips have been arranged for Friday, May 19, for mining men and their ladies. One trip will be to the Eastlake Station of Cleveland Electric Illuminating Co., one of the most modern and highly automated generating plants in the world. It is the northern terminus of the famous coal pipeline from Cadiz, Ohio, and visitors will be especially interested in the facilities to dewater the slurry and prepare the fine coal for use under the boilers.

The other trip will include a tour of Republic Steel's Cleveland Works, ninth largest steel plant in the world, and will provide a first-hand inspection of the ore docks, coke plant, huge blast furnaces, and the largest continuous strip mill ever built. The afternoon portion of the trip will be devoted to a scenic cruise on the Cuyahoga River and the lake harbor, with cocktails and lunch served on board.



H. G. Dillon
Assistant to President
Lee-Norse Co.
Chairman, Welcoming Committee

MAKE PLANS NOW TO ATTEND

The AMC Coal Show is held for one vitally important reason—to give the mining industry a chance to see and hear about the latest developments in methods and equipment for improving efficiency and reducing production costs. It adds up to the industry's “best deal” of the year! No progressive mining man can afford to miss it. Make plans now to attend. All hotel and motel reservations are being handled through the Cleveland Hotel Reservation Bureau, 511 Terminal Tower, Cleveland, Ohio.

Chairmen and Vice Chairmen



1



2



3



4



5



6



7



8



9



10



11



12



13



14



15



16



17



18



19



20



21



22

CONVENTION

Monday, May 15

Ballroom, 4th Floor

9:45 A.M. Pre-Session Motion Picture—

"Horizon North" (A new iron mining operation in Labrador)

10:00 A.M. OPENING SESSION

Presiding:

R. E. SALVATI, Pres., Island Creek Coal Co.,
Huntington, W. Va.; Pres., American Mining
Congress

Presentation of The Colors:

Order of the Arrow, Honor Campers, Greater
Cleveland Council, Boy Scouts of America

Invocation:

REV. LEWIS RAYMOND, Pastor, Old Stone Presby-
terian Church, Cleveland

Remarks:

JESSE F. CORE, Vice Pres.—Ops.—Coal, U. S.
Steel Corp., Pittsburgh; Chairman, Coal Divi-
sion, American Mining Congress

F. STILLMAN ELFRED, Chr. of the Board, Peabody
Coal Co., St. Louis; Chairman, Program Com-
mittee, American Mining Congress

D. E. DAVIDSON, Vice Pres. for Sales, Link-Belt
Co., Chicago; Chairman, Manufacturers Divi-
sion, American Mining Congress

ROBERT M. HARDY, JR., Pres., Sunshine Mining
Co., Spokane; Chairman, Western Division,
American Mining Congress

Address:

HON. JOHN M. KELLY, Assistant Secretary for
Mineral Resources, Department of the Interior

A Look at Coal's Future

CHARLES J. POTTER, Pres., Rochester and Pitts-
burgh Coal Co., Indiana, Pa.

PROGRAM

Tuesday, May 16



Ballroom, 4th Floor

8:45 A.M. Pre-Session Motion Picture—

"Alaska—Its Natural Resources"

9:00 A.M. CONVENTIONAL MINING

Chairman:

C. C. CORNELIUS, Exec. Vice Pres., Emerald Coal & Coke Co., Pittsburgh

Vice Chairman:

VIRGIL A. CURRY, Mgr. of Mines, The Youngstown Mines Corp., Huntington, W. Va.

Conventional Mining in Thin Seams

CLYDE H. STOREY, Dir. of Indus. Engr., Elkhorn Coal Div., Princess Coals, Inc., David, Ky.

Shooting With Air in Low Coal

JOE L. MCQUADE, Senior Exec. Vice Pres., Maust Coal & Coke Corp., Richwood, W. Va.

Maintenance at Moss No. 3

BALLARD TAYLOR, Asst. Supt. of Maint., Moss No. 3 Mine, Clinchfield Coal Co., Dante, Va.

Future of Conventional Mining

JACK MATHESON, Chf. Methods Engr., Island Creek Coal Co., Holden, W. Va.

Clubroom "A", 3rd Floor

8:45 A.M. Pre-Session Motion Picture—

"Your Share in Tomorrow" (The New York Stock Exchange in action)

9:00 A.M. MANAGEMENT AND COST CONTROLS

Chairman:

WHITNEY WARNER, JR., Pres., The Sterling Coal Co., Philadelphia

Vice Chairman:

RALPH B. DEAN, Controller, The Lorain Coal & Dock Co., Columbus, Ohio

Profitable Control of Production and Transportation Through Operations Research

DR. DAVID B. HERTZ, Principal in Charge of Operations Research, Arthur Andersen & Co., New York; and

NORMAN O. OLSON, Partner, Arthur Andersen & Co., St. Louis

Control of Supply Costs Through Inventory Control

W. J. ECK, Gen. Mgr., Purch. & Stores Dept., The Chesapeake & Ohio Railway Co., Cleveland

Saving Money Through Modern Purchasing and Inventory Control

R. A. DODDS, Dir. of Pur., Truax-Traer Coal Co., Chicago

Employee Testing

JOHN E. OSMANSKI, Mgr. of Personnel, Island Creek Coal Co., Huntington, W. Va.

Clubroom "B", 3rd Floor

8:45 A.M. Pre-Session Motion Picture—

"Glacier National Park"

9:00 A.M. STRIP MINING

Chairman:

ARNOLD E. LAMM, Pres., Pittsburg & Midway Coal Mining Co., Pittsburg, Kans.

Vice Chairman:

H. M. TIBBS, Vice Pres.—Ops.—Coal, Truax-Traer Coal Co., Chicago

Inclined Vertical Drilling and Blasting

B. J. KOCHANOWSKY, Dept. of Mng., Pennsylvania State University, University Park, Pa.

Economics of Large vs. Small Haulage Units

E. F. ECKHARDT, Mgr. of Coal Mng., American Electric Power Service Corp., New York

Combination Truck and Belt Haulage

ROBERT S. HUMPHREYS, Chf. Engr., Stonefort Coal Mining Co., Indianapolis, Ind.

Interconnection of Hoist and Crowd Controls—A Step Toward Shovel Automation

A. M. VANCE, Mng. Pet. Chem. Sec., Westinghouse Electric Corp., East Pittsburgh, Pa.

(continued on next page)



Ballroom, 4th Floor

1:45 P.M. Pre-Session Motion Picture—

"Inland Voyage" (Bringing a lake freighter up the Mississippi to Lake Michigan)

2:00 P.M. HAULAGE AND POWER

Chairman:

JOSEPH M. RICHARDS, Gen. Mgr. of Mines, Blue Diamond Coal Co., Knoxville, Tenn.

Vice Chairman:

A. C. MUIR, Elec. Engr., The Berwind-White Coal Mining Co., Philadelphia

Experience With Silicon Rectifiers

JOHN A. DUNN, Chf. Elec. Engr., Island Creek Coal Co., Holden, W. Va.

Use of Brakeman Cars

EMIL J. SERVANT, JR., Asst. Gen. Supt., Olga Coal Co., Coalwood, W. Va.

Application of Diesel Units Underground

PETER S. ZUKOW, Supt., Mines Nos. 7 and 8, Ore Mines & Quarries, Tennessee Coal & Iron Div., U. S. Steel Corp., Fairfield, Ala.

Yieldable Mine Arches

GEORGE L. MAY, Div. Supt., Cambria Div., Bethlehem Mines Corp., Ebensburg, Pa.

Underground Belt Haulage in the United Kingdom

S. WEINBERG, Chf. Engr. (Specialist Service), The National Coal Board, London, Eng.

Clubroom "B", 3rd Floor

1:45 P.M. Pre-Session Motion Picture—

"Blasting Vibrations—Cause and Effect"

2:00 P.M. COST CUTTING IN OPEN PIT MINING

Chairman:

J. R. KRINGLE, Exec. Vice Pres., New York Trap Rock Corp., West Nyack, N. Y.

Vice Chairman:

CARL F. CLAUSEN, Dir., Manufacturing Process Dept., Portland Cement Assn., Skokie, Ill.

Revamping a Mobile Equipment Maintenance Program

HOWARD HANKS, JR., Operations Engr., Marquette Cement Manufacturing Co., Chicago

Maintenance at the Operation

JOHN G. WARNER, Plant Mgr., Chemstone Corp., Strasburg, Va.

Blasting Vibrations in Quarry Operations

DANIEL J. MILLER, JR., Chief Engr., Houdaille Construction Materials, Inc., Morristown, N. J.

Cutting Costs Through Operations Research

JAMES L. COX, Mgr. of Minerals Operations, International Minerals and Chemical Corp., Bartow, Fla.

Control of Large Blasts to Tonnage Requirements

H. A. CORRE, Plant Mgr., Bellefonte Operations, Warner Co., Bellefonte, Pa.





Ballroom, 4th Floor

1:45 P.M. Pre-Session Motion Picture—

"The Magic of Sulphur"

2:00 P.M. COAL PREPARATION

Chairman:

C. K. TIECHE, Vice Pres., Clinchfield Coal Co., Dante, Va.

Vice Chairman:

WM. CRENTZ, Asst. to Chief, Division of Bituminous Coal, U. S. Bureau of Mines, Washington, D. C.

Effect of Continuous Mining Equipment on Cleaning Plant Performance

W. H. NOONE, Supt. of Prep., Semet-Solvay Div., Allied Chemical Corp., Montgomery, W. Va.

Heavy Medium Cyclones

WILLIAM BENZON, Supt. of Prep., Bethlehem Mines Corp., Johnstown, Pa.

An Electric Utility Looks at Its Future Use of Coal

ROGER D. CURFMAN, Fuel Agent, Cleveland Electric Illuminating Co., Cleveland, Ohio

Recent Progress in the Thermal Drying of Fine Coal

R. E. ZIMMERMAN, Vice Pres., The Paul Weir Co., Chicago, Ill.

Clubroom "A", 3rd Floor

1:45 P.M. Pre-Session Motion Picture—

"The Path of Venus" (Story of Pioneer V, the sun-circling satellite)

2:00 P.M. SAFETY

Chairman:

WOODS G. TALMAN, Asst. Vice Pres.—Ops.—Coal, U. S. Steel Corp., Pittsburgh

Vice Chairman:

GEORGE TREVORROW, Safety Dir., Bituminous Coal Operators' Assn., Washington, D. C.

Human Engineering in Safety

C. G. EVANS, Pers. Mgr., The North American Coal Corp., Cleveland

Benefits of a Sound Safety Program

C. O. KANE, Mgr.—Coal Mines, Armco Steel Corp., Montcoal, W. Va.

Evaluation of Various Means of Fighting Machine Fires Underground

DONALD MITCHELL, Chief, Experimental Coal Mine;

JOHN NAGY, Chief, Branch of Dust Explosions; and

EDWIN M. MURPHY, Chem. Engr., Experimental Coal Mine, U. S. Bureau of Mines, Bruceton, Pa.

Design of Pillars for Overburden Support

CHARLES T. HOLLAND, Head, Mng. Dept., Virginia Polytechnic Institute, Blacksburg, Va.

Discussion:

ROY L. DULANEY, Dir. of Safety, Mountaineer Coal Co., Fairmont, W. Va.

Clubroom "B", 3rd Floor

1:45 P.M. Pre-Session Motion Picture—

"Bridge to the Future" (The second phase of the Glen Canyon Dam project)

2:00 P.M. STRIP MINING

Chairman:

G. H. UTTERBACK, Sec.-Treas., United Electric Coal Cos., Chicago

Vice Chairman:

M. R. HECKARD, Supt., Repatee Mine, Midland Electric Coal Corp., Farmington, Ill.

Application and Performance of Wheel Excavators

HENRY RUMFELT, Appl. Engr., Bucyrus-Erie Co., So. Milwaukee, Wis.

Auger Mining Standards and Comparative Costs

LOUIS F. ZAGER, Management Engr., Helmick & Associates, Cleveland

Horizontal Air Drilling

N. O. LEWIS, Chf. Engr., Robbins Machine & Manufacturing Co., Inc., Oneonta, Ala.

Increasing Equipment Availability Through Maintenance

THOMAS P. BRADFORD, Lub. Engr., Hanna Coal Co., Cadiz, Ohio

(continued on next page)

Thursday, May 18



Ballroom, 4th Floor

8:45 A.M. Pre-Session Motion Picture—

"Europe and You"

9:00 A.M. COAL PREPARATION

Chairman:

R. K. BOGERT, JR., Pres., Badger Coal Co., Philippi, W. Va.

Vice Chairman:

R. L. LLEWELLYN, Mgr. of Prep., Eastern Gas and Fuel Associates, Pittsburgh

Planning for Efficient Cleaning Plant Operation

JAMES B. GIROD, Asst. Gen. Supt., Maple Creek Div., Frick District, U. S. Steel Corp., Uniontown, Pa.

Latest Developments for Continuous Analysis

LOY A. UPDEGRAFF, Proj. Engr., Bituminous Coal Research, Inc., Columbus, Ohio

Substitutes for Standard Materials to Reduce Maintenance Costs

V. D. HANSON, Mech. Engr., Consolidation Coal Co., Library, Pa.

Processing and Disposal of Coal Flotation Tailings

DONALD A. DAHLSTROM, Vice Pres. and Dir., The Eimco Corp., Research and Development Center, Palatine, Ill.

Clubroom "B", 3rd Floor

8:45 A.M. Pre-Session Motion Picture—

"Prestressed Concrete"

9:00 A.M. NEW OPERATIONS

Chairman:

CECIL ARNOLD, Vice Pres. of Engr., Peabody Coal Co., St. Louis

Vice Chairman:

HARRY LAVIERS, JR., Exec. Vice Pres., South-East Coal Co., Inc., Irvine, Ky.

Orient No. 5

THOMAS L. GARWOOD, Chf. Engr., Freeman Coal Mining Corp., West Frankfort, Ill.

Thunderbird

W. A. ENDICOTT, Gen. Supt., Ayrshire Collieries Corp., Indianapolis, Ind.

Segco No. 1

J. E. BROWN, JR., Mgr. of Coal Oper., Southern Electric Generating Co., Birmingham, Ala., and

G. C. DYAR, Vice Pres.—Coal Mng. Oper., Alabama By-Products Corp.

Sunnyhill No. 9

E. W. PEARSON, Supt., Sunnyhill Mine No. 9, Peabody Coal Co., New Lexington, Ohio

Ballroom, 4th Floor

1:45 P.M. Pre-Session Motion Picture—

"Secrets of the Ice" (The science of glaciology unlocks man's past)

2:00 P.M. CONTINUOUS MINING

Chairman:

N. T. CAMICIA, Vice Pres.—Oper., Island Creek Coal Co., Holden, W. Va.

Vice Chairman:

J. ALLAN BROOKES, Mgr., Mather Collieries, Pickands Mather & Co., Mather, Pa.

Continuous Mining in Thin Seams

NORMAN YARBOROUGH, Gen. Mgr., Harlan Fuel Co., Yancy, Ky.

Continuous Mining in Thin Seams

J. L. MARSHALL, Supt., Keystone Mine, Imperial Coal Co., Clymer, Pa.

Maintenance of Continuous Mining Equipment

ARTHUR TOWLES, Maint. Engr., Bell & Zoller Coal Co., Johnston City, Ill.

Face Ventilation and Dust Control

JOHN S. TODHUNTER, Gen. Mgr., Barnes & Tucker Co., Barnesboro, Pa.



EXHIBITORS



ACME MACHINERY CO.

Is planning to exhibit a rotary, self-propelled, mine air compressor with four-wheel drive and tractor-type steering, and a low vein rotary hydraulic roof drill. Accessory products for the mining industry will also be shown.

AEROQUIP CORP.

Main feature will be a detachable, reusable segmented fitting for large diameter hose in hydraulic systems where pressures up to 3000 psi are encountered. Other products to be shown include flexible hose lines with detachable reusable, fittings, self-sealing couplings, formed tube assemblies, clamps, bands, straps, load control and cargo tie-down equipment.

ALLEGHENY LUDLUM STEEL CORP. CARMET DIVISION

Will show its complete line of tungsten carbide tipped mining bits including the Quick Change type for hard cutting, standard 1/2-in. by 1-in. cutter bits for mining machine applications, and coal drill and roof drill bits as well as a specially designed bit for cutting salt.

ALLIS-CHALMERS MANUFACTURING CO.

Introduction of the TL-30 tractor loader with 184-hp diesel engine will be the highlight of the display. Exhibit will also include a crawler-tractor with U blade, operating model of a Ripl-Flo screen, an 8 by 16-ft Low-Head screen with motor, high voltage motor control, motor control center, 200 kw generator set, off highway diesel engines, compressor, and solids-handling centrifugal pump.

ALLIS CO., LOUIS

Will exhibit a complete line of a-c and d-c rated motors available in explosion-proof, enclosed and open construction. A specially designed permissible a-c shuttle car motor will be featured along with a liquid cooled adjustable speed magnetic drive for conveyor applications.

ALLISON DIVISION GENERAL MOTORS CORP.

Display will consist of cutaway transmissions in color. These are designed to show all internal workings of representative transmissions and converters for on- and off-highway applications.

AMERICAN AIR FILTER CO., INC.

Two different types of wet dust collectors will be shown; a hydrostatic precipitator and a dynamic precipitator. The company's complete line of dust control products, including dry and wet collectors, fabric arrestors, and electrostatic precipitators, will be featured in the background display.

AMERICAN BRATTICE CLOTH CORP.

Will show its line of jute, canvas and plastic brattice cloth and the various grades of each. In addition, there will be Mine-Vent blower type ventilation tube, wire reinforced MineDuct exhaust tube, ABC powder bags and trolley guard on display.

AMERICAN BRIDGE DIVISION UNITED STATES STEEL CORP.

Will emphasize roof bolts, drainage products, and the fabrication and construction services it offers the coal industry.

AMERICAN CABLE AND HAZARD WIRE ROPE DIVISIONS AMERICAN CHAIN & CABLE CO., INC.

Will have as the main feature of its exhibit very high strength—VHS—wire rope for use on scrapers, dozers, shovels and draglines.

AMERICAN CYANAMID CO. EXPLOSIVES & MINING CHEMICALS DEPT.

The company's complete "Drilling-to-Shipping" line for the coal industry will be on exhibit. Among new products to be shown are AM-9 chemical grout, and Cyagel 100 slurry explosive; also ammonium nitrate, improved permissibles, a water resistant blasting agent, electric blasting caps and primers. Settling characteristics of the company's flocculents will be demonstrated and an erosion resistant binder compound, for use on portal entries and in connection with storage and shipping of coal fines, will be shown along with other chemicals for the mining industry.

AMERICAN MANGANESE STEEL DIVISION AMERICAN BRAKE SHOE CO.

Manganese steel coal loading buckets, tractor shoes, end bits and dipper teeth will be featured. Under the theme, "Pair for Wear," two hard facing rods designated Nicro Mang and X-53 and intended for most build-up and hard facing work will be displayed.

AMERICAN MINE DOOR CO.

On display will be a self-propelled rock duster, a heavy duty track cleaner, and recent developments in mine doors.

AMERICAN OIL CO.

Featuring its new facilities to serve the coal mining industry, the company will show diesel fuel, heavy duty motor oils, multi-purpose additive type circulating and hydraulic oils, and leaded lubricant #12 for mining machinery.

AMERICAN STEEL & WIRE DIVISION UNITED STATES STEEL CORP.

See United States Steel Corp.

(Continued on next page)

COAL SHOW EXHIBITORS

ANACONDA WIRE & CABLE CO.

Different types of electrical wire and cable used both above and below ground will be shown—including a new flat a-c shuttle car cable; standard, D-shaped, flat d-c shuttle car cable; shovel cable, and new items of Telephonic communication wire.

ARCAIR COMPANY

Live demonstrations of metal-removal torches will be conducted continuously. Using an electric arc to melt the metal and compressed air to remove it when liquefied, the Arcair process can be used on any type of metal.

ASHLAND OIL & REFINING CO.

Exhibit will concentrate on coal spray oils, lubricants, and a coal spray pumping unit.

ATLAS POWDER CO.

Atlas pellets, a new physical form of fertilizer grade ammonium nitrate for blasting, will be featured, along with other blasting agents and explosives. New permissible explosives for underground mining will be introduced, and an animated display will illustrate advantages of casting overburden into the spoil pile with explosive energy.

AUSTIN POWDER CO.

Display will feature products from its line of permissible and regular explosives, mining equipment, detonating fuse, and ammonium nitrate.

AUTOMATIC VULCANIZERS CORP.

Exhibit will consist of conveyor belt repair material. Emphasis will be on Pang self-vulcanizing rubber compounds for sealing and patching without heat or pressure.

AUTOMATIC WELDING CO. SUBSIDIARY OF THE McKAY COMPANY

Intends to show a Micro-Matic automatic welding machine in operation. This equipment is used for rebuilding tractor idlers and rollers. Other automatic welding machines for various applications will also be featured in the display.

BALDWIN-LIMA-HAMILTON CORP. CONSTRUCTION EQUIPMENT DIVISION

Plans an attractive and informative display illustrating Lima equipment for the mining industry.

BARRETT, HAENTJENS & CO.

Will feature its line of mine, slurry, and submersible pumps for applications in the coal industry.

BEARCAT TIRE CO.

Will show a new kind of solid off-the-road tire designed to replace pneumatic and laminated types.

BEARING SERVICE CO.

Emphasis will be on ball and roller bearings of all types. Also featured will be a complete line of ball and roller bearings, pillow blocks, flange and take-up units, anti-friction devices for mining machinery and equipment, and special units for troublesome applications.

BETHLEHEM STEEL CO., INC.

Will exhibit sections of heavy-duty mine trackwork such as switch material, guard rail, frogs, switch stands, steel ties, and rail. Other products on display will include wedge and shell type mine roof bolts, mine roof ties, hollow drill tool steels, and wire ropes and slings.

BIRD MACHINE CO.

Operation of a full size Bird-Humboldt oscillating screen centrifuge for dewatering minus $\frac{3}{8}$ -in. coal from screens or sludge tanks, and for dewatering of stoker size coal ($1\frac{1}{4}$ by $\frac{1}{4}$ in.) so that it will not freeze in cars will be demonstrated. A scale model of a continuous solid centrifuge for dewatering $\frac{3}{8}$ -in. by 0 table product without prethickening or screening will also be shown as will illuminated flow diagrams of various methods of fine coal preparation.

BIXBY-ZIMMER ENGINEERING CO.

A moving display will feature Bixby-Zimmer all welded stainless steel screens. In addition, there will be an exhibit of various types of available screen rods emphasizing details of regular and special construction.

BOSTON WOVEN HOSE & RUBBER DIVISION AMERICAN BILTRITE RUBBER CO., INC.

Will highlight its exhibit with displays of BostRon conveyor belting, balanced belt construction, and Dulon covers. A complete line of industrial hose and V-belts will also be exhibited.

BOWDIL COMPANY

Products to be shown include a new heavy duty chain for continuous mining machines, a new cutter-bar for universal type mining machines, and a new thin kerf chain for coal mining machines of 20 hp or less. Borod tipped bits, carbide tipped bits, and tool steel bits will also be on display.

BOYERS MACHINERY & SUPPLY CO.

See J & J Coal & Equipment Co.

BRAD HARRISON CO.

Will display single and multi-conductor connectors integrally molded in neoprene for services from 600 to 7500 volts. To be included are push-pull and bronze encased coupling types in addition to a multi-conductor, high voltage, quick disconnect type.

BRODERICK & BASCOM ROPE CO.

Plans to display a continuously operating miniature wire rope stranding machine and miniature wire rope closing machine. Samples of wire ropes used in mining equipment will also be exhibited.

BUCYRUS-ERIE CO.

A 115-cu yd stripping shovel, the world's largest, being built for a midwest coal producer will be the central theme of the exhibit. A photographic presentation of seven machines that have been developed for the coal industry since the 1959 Coal Show will also be featured. Machines to be portrayed include wheel excavators, the Model 61-R rotary blasthole drill, 18 and 34-cu yd walking draglines, 15 to 18-cu yd shovel, 90-cu yd stripping shovel and 9-cu yd dragline.

BUELL ENGINEERING CO., INC. CLASSIFYING SYSTEMS DEPARTMENT

Demonstration models of three types of air classifiers that are used in the coal grinding circuit to separate dry material according to particle size will highlight the exhibit.

BURNDY CORPORATION

A complete line of electrical connectors and fittings for all types of service will be displayed. Live demonstrations will be used to exhibit Hydent compression connectors for #22 wire through 200 MCM, bolted connectors and devices, terminals, tees and ground connectors. Also to be emphasized are cable pulling compounds and a method for welding copper-to-copper or copper-to-steel without an external power source.

CATERPILLAR TRACTOR CO.

Products to be shown will include a new 420-hp tractor coal hauler with torque divider power shift transmission; a track-type tractor equipped with power shift transmission, U-blade tilt cylinder and ripper; and the 966 wheel Trax-cavator. Also to be on exhibit are a 1673 truck engine; a new 12-cylinder, 950-hp industrial engine; a demonstrator model of the 630 torque divider transmission; and cutaways of the D8 power shift transmission and D330 engine.

CENTRIFUGAL & MECHANICAL INDUSTRIES, INC.

Will exhibit an operating type unit from its regular line of centrifugals.

CHEATHAM ELECTRIC SWITCHING DEVICE CO., INC.

Intends to display electric track switch and derail operators and controllers, switch position indicators, trolley slide operated contact devices, hand operated contact switches, and related equipment.

CHICAGO PNEUMATIC TOOL CO.

A crawler-mounted top-drive rotary drilling rig capable of exerting up to 10,000 lb down pressure will be the featured attraction. Intended for coring, prospecting, blast holing or seismograph work, the rig incorporates a 95-hp diesel drive and 164 cfm air cooled compressor. Also to be displayed are a self-propelled roof bolting drill, hand-held hydraulic coal drill, a scavenger sludge pump, and Air-Blast bits.

CINCINNATI MINE MACHINERY CO.

Will show its line of cutterchains, cutterbars, cutterbits and sprockets. Also featured will be setscrewless cutting lugs, cutterchains and cutting arm holders for use on all ripper and boring type continuous mining machines. Enlarged action pictures will show the use of this equipment.

CITIES SERVICE OIL CO.

Will stress its line of petroleum products for application in the coal industry.

CLETRAC CORP.

Exhibit will present the OC-96 Trans-O-Matic loader with 1 1/8 cu yd bucket, counter-rotating tracks, power shifting and power steering as well as the OC-46 crawler with 3/8 cu yd loader, and the all-purpose OC-4 Overhung crawler with rear mounted tracks and equipment mounting platform.

COAL AGE

Will stress its informational and publishing services designed to serve management officials of coal producing and selling organizations through Coal Age magazine and Keystone Coal Buyers Manual.

COLLYER INSULATED WIRE CO.

Electrical products including insulated wire and cable, switchboards, industrial controls, and connections will comprise the central theme of this display.

**COLORADO FUEL & IRON CORP.
WICKWIRE SPENCER STEEL DIVISION**

Will have an animated display showing the molecular action within Double Gray-X wide rope, and will also feature screens for application in the coal industry. A chart will show the results of fatigue tests on Double Gray-X wire rope.

**COLUMBUS McKINNON CORP.
MINING EQUIPMENT DIVISION**

An operating Model RF 44 shuttle car-to-belt Ratio Feeder featuring folding hopper walls and adjustable height wheels will be the main attraction. A continuous color film will show the equipment in actual operation.

COMMERCIAL TESTING & ENGINEERING CO.

Will exhibit a map indicating the location of various offices providing testing and analysis service to producers and consumers of coal and other raw material users. A new automatic plastometer for determining the plastic characteristics of coal will be demonstrated, and photographs and descriptions of various operations will round out the display.

COM-TRONICS, INC.

Transistorized, miniaturized and modularized communication equipment for replacement of mine telephones and for use in locomotives, preparation plants and other applications will be featured. Also shown will be transistorized, miniaturized and modularized remote control equipment for substations, fans, pump stations, traffic control, hoists, and automatic rail haulage, as well as electronic systems for remote control, supervision and telemetry.

CONNELLSVILLE CORP.

Theme of display will be "Coke Production Goes Back to the Mines" with emphasis on horizontal slot-type coke ovens. Also to be displayed is the company's range of skips, cages, hoists, spraggers, rotary dumps, car feeders, and portable elevators.

**CONNORS STEEL DIVISION
H. K. PORTER CO., INC.**

Will introduce a new roof bolt expansion unit and give prominence to its West Virginia brand of pre-assembled mine roof bolts. Mine ties, angle bars, splice bars and light rail will also be shown.

CONVEYOR BELT SERVICE, INC.

Highlight of the display will be a moving conveyor demonstrating the effectiveness of the company's continuous belt repair process. Also to be featured is a new belt repair plant in Cleveland.

COOKE-WILSON ELECTRIC SUPPLY CO.

Will concentrate on replacement parts for mining machines, conveyor chain repair service and brass repair items.

CUMMINS ENGINE CO., INC.

Plans to introduce to the coal industry three diesel engines including the turbocharged 700-hp VT-12, the naturally-aspirated 350-hp V8-350, and the turbocharged 430-hp VT8-430. The latter two engines are eight cylinder V-types that operate at 2500 rpm and have piston displacements of 950 cu in. Other diesels to be displayed are Models NH-250 and NHC-4 GA (60 kw).

**CURTISS-WRIGHT CORPORATION
MARQUETTE DIVISION**

Will be introducing a line of Grasso pneumatic and hand held tools and will also be showing a line of Swench manual impact wrenches.

**DAVEY COMPRESSOR CO.
ROTARY DRILL DIVISION**

Will introduce a new electric driven, self-propelled, rotary blasthole drilling rig with capacity for drilling 9 in. diam by 125-ft holes and applying 40,000 lb pulldown weight on the bit.

DEISTER CONCENTRATOR CO., INC., THE

Intends to exhibit a commercial size Headmotion drive for a twin-deck Conenco 77 Diagonal Deck coal washing table. Internal moving parts will be visible and the drive will be in operation at reduced speed. Spray nozzles for wet screening and spraying applications will also be shown in operation.

DIAMOND IRON WORKS DIVISION

See Goodman Manufacturing Co.

DIFFERENTIAL STEEL CAR CO.

Will emphasize mine car parts and its line of mine cars and equipment for the coal mining industry.

DODGE MANUFACTURING CORP.

Mechanized displays will demonstrate advantages of Paraflex flexible cushion couplings for standard, high speed—high torque, or flywheel applications. Other products on exhibit are to include Flexidyne dry fluid drives and couplings, speed reducers, sprockets, roller chains, and Dyna-V sheaves and belts.

DORR-OLIVER INCORPORATED

Working models, flowsheets and illustrations will depict Dorr-Oliver's complete line of equipment and processes for thermal drying, cleaning, recovery and refuse circuits.

DU PONT de NEMOURS & CO., INC., E. I.

Plans to stress its better known explosives including a complete line of ten percent salt permissibles.

EIMCO CORP., THE

Plans to feature "Techmations," showing moving diagrams of filtering, thickening and clarifying equipment of the Filter Division & Process Engineers' Division, in addition to a photographic presentation of surface and underground mining equipment.

ELECTRIC AND MACHINE SUPPLY CO.

Display will concentrate on rebuilt equipment including a shuttle car, hoist, hand-held drill, hydraulic drill, and conveyor sections.

ENSIGN ELECTRIC & MANUFACTURING CO.

Will show electrical equipment for underground a-c mining including a portable transformer, distribution box, junction box, and oil filled disconnect switch. Also on display, there will be centrifugal switches for belt conveyors, Type EJ contactors, a-c and d-c magnetic starters and 800 amp plugs and receptacles for a-c mining service.

ERIEZ MANUFACTURING CO.

Its line of a-c operated, vibratory feeders and bin vibrators will be exhibited in medium and heavy duty models for capacities of 75 tph and up. Hi-Power permanent magnetic separators for removing tramp iron from material flows will also be on display.

(Continued on next page)

COAL SHOW EXHIBITORS

ESCO CORPORATION (FORMERLY ELECTRIC STEEL FOUNDRY CO.)

A ripper shank and point featuring a new design concept to permit ripping under adverse conditions will be shown. The points, available in length from 14 to 20 in., are cast in a specially developed alloy steel. Also to be exhibited are a new line of points and adapters for dragline buckets. Dominating the entire display will be four-yd and seven-yd triple tapered dragline buckets.

EUCLID DIVISION OF GENERAL MOTORS CORP.

Three products will highlight the exhibit; a 14-yd struck capacity TS-14 scraper and two C-6 crawler tractors, one equipped with blade and attachments and the other stripped to show power train components and other features. The 14-yd scraper is a new product—with all wheel drive powered by two GM diesel 4-71 engines totaling 296 hp. An exposed model, to show tractor construction and components, and combination live and closed circuit television will be used in the presentation.

FAIRVIEW BIT CO., INC.

Will have on display a semi-automatic bit grinder with four grinders and a rotary table for sharpening cutter bits used in the coal, potash and salt industries.

FEDERAL-MOGUL SERVICE DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC.

Expects to feature its line of bearings and oil seals for mining machinery and equipment. Bower taper and straight roller bearings for heavy duty applications will be among the products displayed.

FEMCO, INC.

Will stress engineering services and special systems for mine applications in its exhibit. Products to be shown are the company's Trolleyphone, loud speaking telephone, and fan and circuit breaker monitoring and remote control system.

FLETCHER & CO., J. H.

Being exhibited for the first time at a Coal Show will be the new Model DM swinging boom roof drill, Model DB 24-in. low drill, Model TTB mine track tamper and Hi-Ex mine foam fire fighting equipment. A movie and small-scale demonstration of the Hi-Ex foam system will be shown. A display of accessories including a rotary impact drill, internal collection system and X-heavy axle for Fletcher machines will round out the exhibit.

FLEXIBLE STEEL LACING CO.

An operating exhibit consisting of a 20-ft conveyor with a 24-in. wide belt spliced with Flexco, Flexco hinged and Alligator belt fasteners will be shown. Other products that will be on display include new countersinking tools, belt cutters and clamps.

FLOOD CITY BRASS & ELECTRIC CO.

Will feature electrical specialty products for mine equipment, trolley line accessories, pump parts, and bronze replacement parts for mining machines. A new hydraulic locomotive brake cylinder will also be shown.

FORD STEEL CO.

Products to be displayed include various sizes and shapes of applicator bars, special sections and castings for repointing dipper and dragline teeth, and the company's line of welding electrodes.

FUEL PROCESS CO.

Highlighted will be an operative, one-third scale model of the M-type heavy media washer incorporating an angle type refuse conveyor complete with integral vibrating, drain screen.

GALIS ELECTRIC & MACHINE CO.

Will display a Model 400 face drill with rotary percussion head; 7½-hp, 25-hp and 75-hp d-c motors, and a Lecco vibrating screen.

GENERAL CABLE CORP.

Exhibit will be built around a map of the United States showing locations of sales offices and distributing centers. Samples of mining cables will be shown along with photographs of actual field installations.

GENERAL ELECTRIC CO. APPARATUS SALES DIVISION

Eight departments will display products for mining and preparation plant applications. Models of the Lectra Haul and a 50-ton locomotive, a motorized wheel display, shovel drive and control system will be shown, as will a 7700 motor control center and a new a-c mine load center. Among other products there will be cemented carbide tools, Polydyne adjustable drives and gear motors, and rectifier cells. Attention will be given to productive maintenance methods.

GENERAL SPLICE CORP.

Conveyor belt repair methods and devices will be emphasized.

GOODMAN MANUFACTURING CO.

Will feature the new type 428 borer powered with 250-hp motors for continuous mining in seams of 66 in. and up, and the new type 201 rotary drum miner for lower measures of coal. Auxiliary equipment for both systems are a new 10-ton capacity shuttle car and Ropebelt conveyor complemented by component units including an adjustable height discharge section. Also to be shown are a low vein loader and shuttle car, rubber-tired universal cutter, Wilcox miner and supply items.

GOODRICH CO., B. F.

Display will include a complete line of conveyor belts, V belts, industrial hose, fire hose, Koroseal pipe and fittings and special products such as clothing items and sheet rubber. A new line of conveyor belts made with a special fire-resisting rubber will be a feature of the exhibit.

GOODYEAR TIRE & RUBBER COMPANY

Exhibit will center about an eight-ft working model of a steel cable conveyor belt in a coal mine slope application. Also to be shown are the company's new double tread idler sleeve for return flight conveyor cleaning, samples of a cold-bonding rubber chute lining material, Armaplate rubber-protected steel sheeting for fabrication of chutes, sluices and hoppers and a line of hose for coal mining service.

GORMAN-RUPP CO.

Centrifugal and diaphragm pumps for coal industry applications will be exhibited. Highlight will be a full scale plastic model of the 3VS1 submersible dewatering pump, a three-in. centrifugal that operates either partially or completely submerged. Working display will demonstrate the solids-handling ability of extra heavy duty pumps.

GOULD-NATIONAL BATTERIES, INC. INDUSTRIAL DIVISION

Plans an exhibit of motive power batteries and stationary type batteries for auxiliary power. Also to be featured is the Silconic battery plate.

GOYNE PUMP CO.

Will demonstrate features of a vertical slurry pump, with no bearings below the mounting plate and no packing box, operating in a sump with a plexiglass window. A horizontal slurry pump with overhead motor mounting, motor, drive and drive guard will also be shown.

GREAT LAKES STEEL CORP.

Will feature applications of X-A-R abrasion resistant steels in its display.

GULF OIL CORP.

A fire-resistant hydraulic oil, which is a 40 percent water in oil emulsion, and a multi-purpose grease, lubricant H.D. for all types of underground mining equipment, will be the main attractions of the Gulf display.

GUNDLACH MACHINE CO., T. J. DIVISION OF J.M.J. INDUSTRIES, INC.

A Model 70 DA crusher, featuring flange mounted rolls, totally enclosed gear boxes and secondary drive, will be displayed along with a Cage-Paktor multiple stage crushing unit. Both machines will be shown in operation at low speeds.

H & L TOOTH CO.

Will be displaying two-part hammer forged alloy steel teeth for two-yd to nine-yd shovel dippers used in coal stripping. Exhibit also will feature replaceable wear plate adapters which eliminates hardfacing and building up adapters in the field.

HAMMERMILLS, INC.

Will exhibit a Universal Wobbler feeder, a Hydrostroke feeder and an Impact Master impact breaker.

HARNISCHFEGER CORP.

The operator's cab from a standard eight cu yd P&H Model 1800 electric mining shovel, completely rigged with authentic control console and electronic control cabinet, will be the center of attraction. Visitors to the cab will, by means of a specially adapted movie of an identical machine at work in the field, get an operator's eye-view of the shovel going through a complete cycle. The "operator" will receive instructions via earphones and will be able to manipulate the controls in synchronization with the movie, which will be projected against the cab window in front of the operator's seat.

HAUGHTON ELEVATOR CO.

Elevators for mine service will be highlighted with stress being given to the use of a-c power in this application. Design and construction features will be illustrated by means of photographs and colored slides of actual installations.

HAWTHORNE, INC., HERB J.

Will show its Blue Demon all-formation drill bits for shot hole, blasthole, core hole and exploratory rotary drilling. A series of four bodies that use throw-away blades provide a complete range of sizes.

**HEIL CO.
TEC DIVISION**

Its line of trailers for transporting coal will be featured in a picture display of case studies. Emphasis will be on the Hy-Spill, Hy-Tec and bottom hopper dump units.

HEINTZ MANUFACTURING CO.

A new all-aluminum edge vulcanizer having 6-in. by 48-in. platens will be on display as well as a lightweight vulcanizer for handling belts up to and including 60-in. widths.

HELWIG CARBON PRODUCTS, INC.

Plans to stress the advantages of Red Top carbon brushes for mining equipment applications.

HENDRICK MANUFACTURING CO.

Samples of various styles and sizes of perforations used in screening will be displayed. Highlighting the exhibit will be Wedge Slot screens; Wedge Wire screens, including cascade and riffle types; and perforated screens of rubber-clad metal.

HENDRIX MANUFACTURING CO., INC.

Will have on exhibit one of the newest Type MH heavy duty mining buckets in a size widely used in coal mining and featuring cast 14 percent manganese lip, chains and fittings.

HERCULES POWDER CO.

Display will depict the company's complete line of permissible explosives which are applicable to coal blasting. Special attention will be drawn to the complete range of detonation rates.

HEWITT-ROBINS

An operating wire rope conveyor that is 60 ft long will be the center of attraction. This equipment incorporates several of the company's products including PVC conveyor belting, Jones speed reducers, union chains, style L idlers, and a hydraulic tensioning unit. Other products to be on exhibit are a single deck 6-ft by 20-ft dewaterizer; a section of live frame to demonstrate the use of tension wedges; deep trough, rubber spiral and style L idlers; conveyor belting; and chain.

HEYL & PATTERSON, INC.

An operating laboratory model of a new froth flotation cell will demonstrate the principle behind the Cyclo-Cell that the company plans to display. A new high-capacity centrifugal coal dryer called the Vibroplane will be unveiled and the exhibit will be rounded out with photographs and flow charts of recently completed coal preparation plants.

HOUGH CO., THE FRANK G.

Two machines, the H-120 loader-dozor with coal blade and the H-90 loader with 4-in-1 bucket, will be shown. The H-120 can be converted from a front-end loader to a dozer as dictated by working conditions. The 4-in-1 bucket makes the rubber-tired H-90 adaptable for use as a conventional bucket, bulldozer, scraper, skid shovel, or clamshell.

HUGHES TOOL COMPANY

Will feature a large diameter rock bit equipped with shaft cutters for sinking mine shafts using the rotary drilling method. Also to be shown is the full line of Rota-Blast rock bits for blasthole drilling using air as a circulating medium.

HUGHES-TYLER MANUFACTURING CO.

A new concept in belt conveying utilizing coil spring resilient belt conveyor idlers for both standard steel and wire rope truss supports will be emphasized in the exhibit.

HUMBLE OIL & REFINERY CO.

Oil products for the coal industry will be featured.

INTERNATIONAL HARVESTER CO.

Intends to exhibit the Model 95 Payhauler, an off-highway rear dump truck, a TD-30 crawler tractor, and two Drott Four-in-One units, the TD-15 and TD-9 or TD-6 with animated bucket. A cutaway version of the eight cylinder UV-549 engine with stripped engine horsepower of 257 at 3400 rpm will round out the display.

INTERSTATE EQUIPMENT CORP.

Aerial tramways will be stressed in an exhibit picturing some new developments in high-capacity automatic conveying tramways and automatic high-speed reversible tramways.

IRWIN-SENSENBACH CORP.

Plans to feature the latest improvements in its all-welded steel, four-wheel mine car trucks and a bearing type king pin section designed to provide easy truck turning. There will also be models of Stream-liner mine cars and Man-Van cars and a working scale model of a Huwood-Irwin G-40 belt conveyor.

J & J COAL & EQUIPMENT CO.

Exhibit will consist of various models of Lister air cooled diesel engines for service in powering pumps, welders and generators and available in one to six cylinder models ranging from 3 to 72 hp.

JEFFREY MANUFACTURING CO., THE

Center of attraction will be the 20½-in. high, 100L auger type continuous mining machine coupled to a 94L bridge conveyor. Other equipment to be shown includes a 25½-in. high Colmol, 81 ALWC loader, twin boom type roof drilling and bolting machine, type 101 shuttle car with operator's cab in the wheel base, rope belt conveyor components, fan, blowers, vibrating feeders, magnetic separator, and renewal parts and accessories.

JOY MANUFACTURING CO.

New continuous miners, the 5CM and Compton CU42, for low coal will be highlighted along with a new low seam team, all 24-in. high, consisting of 16 RB cutter, 14BU10 loader, 6-wheel 18SC shuttle car, and CD61 face drill. Other equipment on display will include a 14BU10 for medium seams, new twin diesel shuttle car, impact crusher, Quick-Change bit holder, Lectronic Sentry and an all-neoprene rubber push-button station. Models will be used to show the effect of angled-hole drilling for blast holes.

KW-DART TRUCK CO.

A new 120-cu yd (struck) coal hauler equipped with 700 hp diesel engine, triple reduction planetary driving axle, and hi-strength variable section alloy frame, will have its first showing in a pictorial presentation. The trailer body has expanded metal sides, lower center of gravity, and universal type hitch for full turn and pivot. Tires are 21.00 x 35, 36 ply rating.

KAISER ALUMINUM & CHEMICAL SALES, INC.

Intends to display a line of electrical cables for the mining industry including mining machine cables, mine power feed cables, borehole cables, as well as welding cable and portable cords.

KEENAN OIL CO.

Will introduce two completely new products yet to be announced but which will be demonstrated in moving displays. Also to be shown is a coal spray oil, made up with a series of seven additives in a clear oil for freeze-proofing, dust treatment and bulk density control.

(Continued on next page)

COAL SHOW EXHIBITORS

KENNAMETAL INC. MINING TOOL DIVISION

Plans to exhibit a complete line of its mining tools, including the full line of cutter bits with latest design changes, drag bits for open pit operations, roof bits, drill bits, drive sockets, and augers. Other products to be on display include Kendex hard surfacing material, rock bit inserts, metal-cutting tools, and an array of wear parts.

KENSINGTON STEEL DIVISION OF POOR & COMPANY

Display will feature products of cast alloyed manganese steel typical of which are dipper teeth, crawler treads, rollers, drive tumblers, dragline chain, hammers, grate bars, liners, chain, sprockets, buckets, sprocket rims and grouser plates.

KERSEY MANUFACTURING CO., INC.

Will feature in its exhibit the 10,000-lb model P-1044 Big Work Horse permissible mine tractor equipped with positive four-wheel drive and limited slip differentials. Two 10-hp permissible continuous duty motors furnish power for this unit which has a starting drawbar pull of 7500 lb.

L & M RADIATOR SERVICE, INC.

Intends to exhibit a cutaway radiator assembly as is used on heavy off-highway vehicles. Display boards and samples of radiator cores will also be shown.

LABORATORY EQUIPMENT CORP.

Display will include an automatic analyzer for volatile matter in coal. A self-timing device, it can make two analyses at a time. A sulfur analyzer for coal and coke that makes rapid analysis possible while using samples up to one-half gram will also be shown.

LeBUS INTERNATIONAL ENGINEERS, INC.

The LeBus spooling system for mine hoisting equipment will be the main feature of the exhibit. A spooling demonstrator with drums grooved for the system will illustrate multi-layer spooling and correction for excessive fleet angle and slack line.

LECCO MACHINERY & ENGINEERING CO.

See Galis Electric & Machine Co.

LEE-NORSE CO.

Display will present three continuous mining machines for mining coal seams in three thickness ranges—from 31 to 48 in., 36 to 60 in., and 56 to 122 in. The low coal model LCM28, which is powered by two 50-hp motors, carries two vertically mounted cutter drums, can cut widths to 16 ft and has a rated capacity of two to three tpm. Model CM32 is for medium-low coal, is equipped with 16-in. wide crawlers and three 50-hp motors, and is rated for mining three to five tpm. The CM48Y has a rated capacity of four to five tpm, features three 75-hp motors, 16-in. wide crawlers and trams at 0 to 80 fpm.

Le ROI DIVISION WESTINGHOUSE AIR BRAKE CO.

New large hole drilling equipment for both rotary and percussion drilling will be on exhibit. Also to be shown are stoppers and other hand-held tools.

LESCHEN WIRE ROPE DIVISION H. K. PORTER CO. INC.

Plans to feature an illuminated background with photographs of the Leschen wire mill and rope mill. On display will be samples of the various sizes, types and construction of wire rope used in coal mining operations including a 3-in. dragline rope and wire rope slings.

LeTOURNEAU, INC., R. C.

Will exhibit models and photographs of electric wheel earth moving and coal hauling units, and will also have a motion picture of a trolley operated hauling unit.

LeTOURNEAU-WESTINGHOUSE CO.

A continuous movie, photo blow-ups and animated features will form the background for the highlight of the display, a Model C Tournatractor with hydraulically operated attachments. Powered by a new 218 hp GM 6V-71 engine, the tractor incorporates an air actuated LW power shift transmission having four speeds forward.

LINK-BELT CO.

A model of the new Fluid-Flo coal dryer, which contains no moving parts and is designed for continuous materials processing, will be the highlight of the exhibit. There also will be a scale model of an air pulsated wash box, a 6-ft by 12-ft vibrating screen with new drives, an MC vibrating feeder, and deep belt conveyor idlers. Operating views of a bucket wheel excavator will show its use in open pit mining operations.

LINK-BELT SPEEDER CORP.

Main feature of the display will be the control system and upper machinery of a $\frac{3}{4}$ -yd LS-78 shovel. Visitors operating the controls will observe the independent power flows for each machine function. Synchronized with the movements of the machinery will be an elaborate electronic panel designed to illustrate how independency of machine operations is made possible.

LONG-AIRDUX CO. DIVISION OF MARMON-HERRINGTON CO., INC.

Theme of the exhibit will be modern high speed face drilling combined with Airdox shooting and "Full Dimension" mining. Components of the system will be shown with the accent on a new mobile coal drilling-shooting machine. This machine incorporates integrally mounted sequence shooting valves and racks for transporting automatic discharge shells. A model mine will illustrate application of Full Dimension to continuous mining. Also to be shown are a newly designed roof bolting machine and a Lo-Rope belt conveyor.

LONG ENGINEERING-DEVELOPMENT CORP.

Drawings and photographs will illustrate recent development in the drilling of large diameter boreholes, with special emphasis on the company's method of shaft sinking through water hazards.

LUDLOW-SAYLOR WIRE CLOTH CO.

Will display samples of industrial woven wire cloth and screens illustrating various weaves and types of openings available.

LUG-ALL CO.

Exhibit will emphasize the new rapid-lowering series of portable winch-hoists that will lower or back off more than one notch at a time and are available in capacities from one-half to two tons. The standard line of winch-hoists and a special "marine" grade for use where corrosion is a problem will also be displayed.

LUKENS STEEL CO.

Special advantages of T-1 steel for the mining industry will be stressed. An unusual 12-ft by 8-ft color transparency depicting a steel mill in operation will also be featured as well as smaller transparencies showing applications of Lukens' products.

MCDOWELL-WELLMAN COMPANIES

The Demag-Lauchhammer materials stacker and bucket wheel excavator will be emphasized in a three-dimensional photo display. Operation and construction of the equipment will be illustrated in photographs. Other exhibits will portray activities of the ABC Scale, Anker-Holth, Dwight-Lloyd laboratories and Williams Bucket Divisions.

McKAY COMPANY, THE

Live demonstrations of its complete line of stainless steel, mild steel, low hydrogen and hard surfacing welding electrodes and automatic wires will be the featured attraction of the display. See Automatic Welding Co.

McLANAHAN CORP.

Will display an 18-in. by 24-in. single roll crusher and a two-stage reduction, 18-in. by 36-in. Triple Roll crusher from its standard line of crushers. A spring loaded toggle device to permit passage of uncrushable material in the two-stage unit will be shown for the first time.

McLAUGHLIN MANUFACTURING CO., INC.

Intends to display rotary drilling tools and accessories, featuring drilling heads and tungsten carbide finger bits. Also to be shown are coal augers, sectional augers, roof augers, internal dust collector rods, heads and other accessory items.

McNALLY PITTSBURG MANUFACTURING CORP.

Will feature a Halstrick screen in operation and a display of cradle idlers against a background consisting of trade marks of companies for which McNally Pittsburg has built coal preparation plants or equipment.

MACWHYTE WIRE ROPE COMPANY

A reel of the entirely new 7-Flex wire rope made up of seven strands and an independent wire rope core will be featured. Various types of cable assemblies and slings for flexible mechanical controls and for heavy hoisting and handling will also be shown along with the latest developments in wire ropes for all types of mining conditions.

MANCHA STORAGE BATTERY LOCOMOTIVE DIVISION

See Goodman Manufacturing Co.

MANITOWOC ENGINEERING CORP.

An authentic western style setting will form the backdrop for projecting color scenes of the workings and applications of the new Model 4500 Vicon seven-yd dragline, which will be the main feature of the exhibit.

**MARION POWER SHOVEL CO.
A DIVISION OF UNIVERSAL MARION CORP.**

Will introduce the world's largest dragline, the Type 8800 with 85-cu yd bucket on a 275-ft boom. Also to be featured is the company's entire line of shovels and draglines. Special emphasis will be given the Type 5760-61 stripping shovels having dipper capacities to 70 cu yd and walking draglines with bucket capacities from 6 to 35 cu yd.

MARTINDALE ELECTRIC CO.

Will exhibit electrical motor commutator maintenance equipment including undercutters, mica saws, commutator grinders and stones. Other products to be shown are voltmeters, ammeters, circuit testers, growlers, tachometers, and insulation testers. Martindale will also display marking tools and protective masks and eyeshields.

MARTIN ENGINEERING CO.

Fifty-two models and sizes of vibration inducers for air, hydraulic, electric, gas and steam operation will be exhibited. The 4½ oz Little Giant and the CCV series Big Shake vibrators will be demonstrated in operation.

MECHANIZATION, INC.

Will present the story of coal from the mining face through the preparation plant. Theme of the exhibit will be "Where is coal going—how will it get there?" Facts and figures will show Mechanization's editorial coverage and penetration of readership. The future growth of the coal industry will also be predicted.

MEGATOR CORP.

A production model of a Sliding Shoe pump will be in operation and representative units in the Model M, K and GH range will be on display along with auxiliary items such as the Dolphin floating suction strainer, Conflow auto spray control, pressure gauges, vacuum gauges and permissible float switches. Plied construction PVC conveyor belting and training and impact idlers will also be exhibited.

**METALLURGICAL PRODUCTS DEPARTMENT
GENERAL ELECTRIC CO.**

Intends to introduce the Carboloy CC-15 mining machine bit, that was developed to meet the requirements of a new design of tool block, and a new Carboloy roof bit. Also to be shown is the company's standard line of bits.

MINE SAFETY APPLIANCES CO.

Will feature the latest Edison electric cap lamp with automatic low-voltage charging, MSA fluorescent mine light systems, mine communication systems, including an improved MinePhone, and a new paging system. The Airslide rockdust distributor, a bulk rockdust conveyor, and dust collector will be shown in addition to the company's line of personal protection equipment—breathing apparatus, self-rescuers, first aid supplies, safety clothing, protective hats, caps and a complete line of eye and face protection equipment.

MINING CONGRESS JOURNAL

Official publication of the American Mining Congress will stress its services to the coal mining industry.

MINING MACHINE PARTS, INC.

Representative electrical and mechanical replacement parts for continuous miners, loading machines, shuttle cars, and related equipment will be exhibited. Featured will be the complete MMP heavy duty conveyor chain line embodying roll pin design for flight attachment.

MINING PROGRESS, INC.

Under the theme, "Successful long-wall mining in U. S. mines," the exhibit will feature a full size operating Westfalia coal planer with separated planer-conveyor drive units and a new self-advancing hydraulic roof support system.

MINING AND QUARRYING

Will emphasize its publication services for the mining industry.

MOBIL OIL CO.

Two new products for coal mines will be featured; a fire-resistant hydraulic fluid and a semi-fluid lubricating grease. Live demonstrations will dramatize product properties.

**MOTOROLA COMMUNICATION & ELECTRONICS, INC.
SUBSIDIARY OF MOTOROLA INCORPORATED**

Highlight of the exhibit will be a working closed circuit television system consisting of a compact industrial TV camera and 14-in. video monitor. Also to be demonstrated is a 14-oz pocket-sized fully transistorized FM radio transmitter, which operates on standard VHF two-way mobile communications frequencies, and its companion pocket-sized receiver.

MOUNTAIN STATE EQUIPMENT CO.

Will feature its line of safety equipment and other products for the coal industry.

**NATIONAL ELECTRIC COIL
DIVISION OF McGRAW-EDISON CO.**

Will emphasize the Neccobond insulation system, showing coils and rotating units which have been wound and vacuum impregnated in Neccobond epoxy resins that have high resistance to heat and moisture.

**NATIONAL ELECTRIC DIVISION
H. K. PORTER CO., INC.**

Featured in the National Electric Division exhibit will be Indestructo mining machine cables which will be displayed by means of cutaways.

NATIONAL IRON CO.

See Hammermills, Inc.

NATIONAL MALLEABLE & STEEL CASTINGS CO.

Two new rubber load suspension applications for mine cars will be shown together with other rubber load suspension units and full size assemblies of the Williston automatic coupler and National rubber cushioning devices. An NC-1 mine car truck will also be on display.

NATIONAL MINE SERVICE CO.

Exhibit will feature two new product lines, ManKar personnel carriers and Transfeeder belt loaders. A complete series of a-c and d-c single motor, torque-converter shuttle cars will be shown in operation and demonstrations of Wheat National lamps will be made. Other products on display will include new design conveyor chain, belt fasteners, PVC conveyor belting, methane indicators, safety and first aid equipment.

**NATIONAL TUBE DIVISION
UNITED STATES STEEL CORP.**

See United States Steel Corp.

NOLAN COMPANY, THE

Exhibit will consist of full size working models of hydraulic Porta-Feeders and full automatic mine car loading stations.

NORDBERG MANUFACTURING CO.

Will include operating models of all Symons screens which are applicable to the coal industry in its exhibit.

(Continued on next page)

COAL SHOW EXHIBITORS

NORTONS-TIVIDALE LIMITED

Is planning to exhibit a working scale model of a dense medium coal washing plant.

OHIO BRASS CO.

Lightning arresters, capacitors, insulators, hardware for a-c power transmission, expansion shells and plugs for roof support are among products that will be on display. Also to be shown are circuit interrupters, cable fault locators, motor starters, taps, and ground clamps; support fittings, switches, and insulators for feeder lines; valves; rail bonds, collectors, and line materials for electric haulage.

OHIO CARBON CO.

Emphasis will be on the company's carbon brush service for all makes of equipment. A simplified replacement brush order system will be demonstrated and sample brushes in a variety of grades will be on display.

OKONITE CO., THE SUBSIDIARY OF KENNECOTT COPPER CORP.

Plans an automated display emphasizing underground cable systems of the future. The entire system, from cutting to preparation plant, is operated by remote control through electronic sensing devices by an operator in a self-contained portable unit away from the mine.

OLIN MATHIESON CHEMICAL CORP.

Three new products are to be shown including a line of electric blasting caps that feature precision timing in an extended series of 30 delay periods. A Super-Prime primer for desensitizing explosives and blasting agents will also be displayed as will an Airbreaker—automatic shell and safety flow control valve for improved underground air shooting.

OLIN MATHIESON LTD.

See Olin Mathieson Chemical Corp.

OLIVER CORP., THE

See Cletrac Corp.

OSMOSE WOOD PRESERVING CO. OF AMERICA, INC.

Will exhibit up-to-date wood preserving equipment, methods and preservatives.

PLM PRODUCTS, INC.

Will feature a 7500 volt, 300 amp coupler that was introduced at the 1959 Coal Show.

PARKERSBURG RIG & REEL CO.

Is planning to concentrate on exhibiting the Hydrotarder brake, a dynamic power absorption unit using water or oil as a medium to govern the speed of heavy trucks, elevators, belts or similar material handling equipment. Heat generated by operation of the brake is dissipated through a heat exchanger and the fluid recirculated through the brake.

PATTIN MANUFACTURING CO. DIVISION OF EASTERN MALLEABLE IRON CO.

An animated display composed of a roof bolt, plate and expansion shell will show how the shell expands when the bolt is tightened. A miniature mine tunnel will illustrate installed roof bolts and plates and show a method for hanging trailing cable on cable hangers.

PENN MACHINE CO.

Representative replacement parts for various makes of cutting machines and shuttle cars will be featured. Also to be shown are Super-Weld rail bonds for use in electrified mines.

PETERSON FILTERS AND ENGINEERING CO.

Plans to demonstrate its Dual Guide and Contour scrapers for disc filters. A new scraper blade profile, which makes the blade more rigid and self cleaning, will be introduced as will a new safety feature.

PLYMOUTH LOCOMOTIVE WORKS DIVISION OF FATE-ROOT-HEATH CO.

In addition to having a hospitality center, Plymouth will feature a model train layout and pictures of its line of locomotives. A full size exhaust conditioner as used on Mine-O-Motives will also be shown.

PROTO TOOL CO. DIVISION OF PENDLETON TOOL INDUSTRIES, INC.

A complete line of hand tools, including punches, chisels, pullers, hammers, and sockets with attachments, will be the highlight of the display. These will be shown in all sizes. Special tools used in mining operations and machinery maintenance will also be exhibited and demonstrated.

PROX CO., INC., FRANK

Main feature will be PT-2 and PT-3 taper shank bits and holders for continuous and conventional underground and auger mining equipment. Exhibit will center about a large model of the taper shank bit, and working models will illustrate advantages that this type of bit offers. Other products to be shown include a complete line of cutter chains, cutter-bars, and other items for conventional mining as well as ripper and trimming chains for continuous miners.

PURE OIL COMPANY

Will stress high-quality lubricants for the coal industry, including hydraulic oils, gear lubricants, loader and service greases, and gear-shield greases.

RAVENS-METAL PRODUCTS, INC.

Center of attraction will be two dump trailers from the company's line of coal trailers and bodies. One of the units has a 30 cu yd box and capacity for up to a 42,000 lb payload. The other unit, a Tri-axle dump trailer, is equipped with a 36 cu yd box and will handle up to 53,000 lb.

RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIVISION

To be featured in the display are the new lightweight Coal-mover conveyor belt with neoprene covers, a conveyor belt for 45° idler operation and a new mechanical belt splice. Other products will include a new type of V-belt drive using specially designed pulleys, trolley wire guards, flexible pipe, and rubber-lined pipe in addition to air and water hose.

REMA-TECH, INC.

Plans to display a conveyor belt showing examples of repairs that were made using the Rema cold vulcanizing method. Samples of vulcanizing kits, patches, rubber cover stock and equipment will be shown and application of specially treated cleats to conveyor belts will be demonstrated.

REPUBLIC STEEL CORP.

Will concentrate on mine roof bolts in its exhibit. New features to be shown include a protective plastic shell cover that is self-removable upon installation of the bolts, and a longer RS-1 shell plug for added expansion in soft strata. Plastic pipe, electrical conduit, track bolts, and track spikes are among other products that will be on display.

RHEINSTAHL WANHEIM GMBH

See Stahlunion Corp.

RIDGE EQUIPMENT CO.

Display will be highlighted by a working model of an Airjig preparation plant complete with surge bin, Airjig, prefabricated dust collector system and conveyors. Also to be shown is a new line of variable speed feeders for coal blending.

ROBERTS & SCHAEFER CO.

An operating model of a heavy medium cyclone for washing fine coal at any desired specific gravity will be featured.

ROEBLING'S SONS DIVISION, JOHN A. COLORADO FUEL & IRON CORP.

Wire rope types most widely used in the mining industry will be on display. Two colorful motion units will highlight an extra strong grade designated Royal Blue and a wire rope construction called Herringbone for use on mobile equipment.

ROME CABLE DIVISION OF ALCOA

Display will be focused on the Rome 60 Line of lead-molded neoprene-jacketed portable cords and cables used in electrification of mobile mining equipment. Related insulated cable products illustrating particularly the utilization of aluminum conductors will supplement the featured exhibit.

RUST-OLEUM CORP.

Applications of rust preventive coatings in various colors and types will be highlighted by color transparencies incorporated in the display.

SALEM TOOL CO.

Will show a new dual auger coal recovery drill and pictures of the machine in operation, a complete display of drilling heads for dual and single auger drills in addition to drilling head breakers and pilots for making various sizes of coal. A complete line of augers and drilling heads for horizontal and vertical highwall drills will also be exhibited.

SANFORD-DAY CORP.

Plans to exhibit for the first time an automatic drop bottom mine car with overlapping ends, spring-mounted trucks and hard faced fabricated steel wheels, employing a new low alloy high strength steel that reduces tare weight of the car. Schematic drawings will illustrate automatic controls for loading the car. Also to be shown is the HKI hoist and drawings of Sonar controls used for automatic car loading at the tippie. Movies will show the company's haulage system and a rock loader in operation.

SCHRAMM, INC.

Will exhibit two self-propelled, self-contained rotary drill rigs for blasthole drilling, the Model C42 crawler-mounted Rota-drill and Model P41 Pneumatractor mounted Rota-drill. Also to be on display is the Model 250 Pneumatractor with DR-126 drifter on feed for eight-ft steel changes and ten-ft feed in all directions.

SCHROEDER BROTHERS CORP.

Intends to show a Bantam Bolter roof drill, Stamler hydraulic car spotter and automatic loading station. Hydraulic line filters for mining machinery will also be on display and a working hydraulic panel will demonstrate the use of a portable hydraulic circuit tester.

SECURITY ENGINEERING DIVISION DRESSER INDUSTRIES, INC.

Illustrations of the step by step manufacturing process and quality control methods used in producing rock bits will serve as a backdrop for displaying the complete line of Super-Aire blasthole bits. These represent a wide variety of sizes and types for application in the coal stripping industry.

SHELL OIL CO.

Will emphasize applications of 3XF mine fluid and Macoma oil in the coal mining industry.

SIMPLEX WIRE & CABLE CO.

Exhibit will give prominence to a broad range of power and control cables for the mining industry. Among the items to be shown, rubber-jacketed, cured-in-lead, Tires heavy duty cords and cables will be featured. Samples of C-L-X sheathed cables are also to be displayed along with photographs of installations in coal preparation plants.

SMITH CORP., A. O. AERONAUTICAL-WESTERN DIVISION

An operating portable submersible electric pump will emphasize features of the company's new 900 series 3/4-hp submersibles. The 900 series is less than one ft long, under six in. diam, weighs 20 lb and has outputs up to 120 gpm. Also to be displayed is the five hp, a-c and d-c, line of pumps.

SPENCER CHEMICAL CO.

Intends to emphasize the use of ammonium nitrate as a constituent in field compounded blasting agents. Other products to be featured are a pneumatic AN-FO placement machine with air operated valves and a high velocity, high temperature initiator especially for use with AN-FO mixtures.

STAHLUNION CORP.

Intends to display friction type and hydraulically operated steel roof supports including a self-moving unit. Other products on exhibit will include hydraulic and friction type yielding steel props, yielding and rigid mine arches, and chain, belt and steel plate conveyors.

STAMLER CORP., THE W. R.

See Schroeder Brothers Corp.

STANDARD OIL CO. (OHIO)

Petroleum products for coal industry applications will be stressed.

STRATOFLEX, INC.

A complete line of detachable, reuseable and permanently attached hose fittings and hose assemblies for the mining industry is to be on display.

SUN OIL COMPANY

Plans to introduce a special VP lubricant pump and to feature two working demonstrations, one of which will compare 740A-EP lubricant with a conventional SAE 140 EP gear oil under simulated working conditions. The other demonstration unit will show the fire resistant properties of Minesafe hydraulic fluid.

TEMPLETON, KENLY & CO.

Plans to show a newly developed lightweight aluminum mine trip post jack for supporting mine roofs in roof bolt recovery or as a temporary post to protect equipment. Also to be displayed are one-way and two-way hydraulic rams in 10 to 100-ton capacities, portable hydraulic pullers in 30 to 100-ton capacities, the Simplex line of hydraulic two and three hook push-pullers in 20 and 30 ton units and various types of ratchet jacks.

TEXACO INC.

The theme of Texaco's exhibit will be "organized lubrication" and the savings this makes possible in equipment operating costs. Industrial lubricants used in the coal industry will be featured.

THERMEX METALLURGICAL, INC.

Will display a new Thermit welding procedure that makes it possible to complete a rail weld without preheating of rail ends prior to welding and requires no equipment. The method employs factory-made, preformed molds and expendable materials supplied in a kit in sufficient quantity to make one weld.

THERMOID DIVISION H. K. PORTER CO., INC.

Exhibit will consist of a display panel featuring Plasticoal and Thermocoal belting and the new Thermocoal double weave belt. Hydraulic hose will also be shown. Focal point of the exhibit will be an eight-ft diam wheel of fortune depicting products of the division.

TIMKEN ROLLER BEARING CO.

Tapered roller bearings, removable rock bits and alloy steel will be highlighted in the exhibit. A working model of an AP type railway bearing application will be shown as will other bearings used in coal mining applications. A continuous color movie will describe various uses of tapered roller bearings. There will be a special display of the various sizes and series of removable rock bits.

TOOL STEEL GEAR & PINION CO.

Plans to exhibit cutaway samples of products which it furnishes to the mining industry. Mining machinery parts will be mounted for easy examination and several photographs showing applications of Tool Steel products will be incorporated in the display.

TWIN DISC CLUTCH CO.

In addition to its standard product line, Twin Disc will show two new products, transmissions and universal joints. On display will be a five-forward, one-reverse speed power shift transmission, as well as a four forward-four reverse speed unit. A new universal joint featuring a caged roller bearing design and nylon washer will also be shown.

TYLER CO., THE W. S.

Will be exhibiting a new model 5-ft by 12-ft, two-surface vibrating screen, a two bearing screen of modular design supplied without a supporting base. The display will include a Ro-Tap testing sieve shaker, testing sieves made to ASTM specification E-11-60-T, and samples of wire cloth specifications.

(Continued on next page)

COAL SHOW EXHIBITORS

UNION WIRE ROPE ARMCO STEEL CORP.

Will feature its machine braided nine-part fabric Tuffy slings in 13 standard types. An overhead crane display will show how sling stresses increase at various fleet angles while load remains constant. Samples of slusher, dragline and scraper ropes will also be shown.

UNITED STATES RUBBER CO. MECHANICAL GOODS DIVISION

Display will concentrate on conveyor belting, pilot flexible pipe, hose, packing, expansion joints and power transmission belting. An operating timing belt clock will demonstrate the accuracy of the company's drive unit.

UNITED STATES STEEL CORP.

Will feature the USS Idea Mine, in which the steel products and services offered to the coal mining industry by U. S. Steel and its divisions are stressed. Among the products on display in the Idea Mine are Man-Ten, Cor-Ten, Tri-Ten and T-1; stainless steels, wire rope, Amerclad cord and cable, mine roof bolts and polyethylene pipe. Divisions of the company represented in the exhibit are American Steel and Wire, American Bridge, National Tube, and United States Steel Supply Division.

UNITED STATES STEEL SUPPLY DIVISION UNITED STATES STEEL CORP.

See United States Steel Corp.

U. S. STONEWARE CO.

Intends to display ceramic and organic lining materials. Several shapes and sizes of abrasion resistant compositions of ceramic materials will be exhibited. Organic (plastic) materials to be shown will be illustrative of coatings and linings that are resistant to abrasive and corrosive conditions.

UNIVERSAL ENGINEERING CORP.

See Hammerrills, Inc.

VAREL MANUFACTURING CO.

A new concept in rotary rock bits for blasthole drilling will be stressed. The engineering principles involved are said to be a major breakthrough in bits designed for use in overburden stripping.

VASCOLOY-RAMET CORP.

Cutter bits CMC and CMF for use in quick-change blocks will be among four new bits to be featured in the exhibit. The CMC and CMP incorporate a shroud which surrounds the bit opening and is intended to reduce block wear due to bit wobble. A new CCMJ with high rake design is for use in auger-type continuous miners for low coal. Also to be displayed is a short shank roof bit with either square or rectangular shank for use in suction type dustless roof drills.

VIBRA-TECH ENGINEERS, INC.

Will emphasize its protective services available to explosives users with blasting vibration or noise problems. Featured in the exhibit will be a seismograph which is used exclusively in the company's protection programs. A working model of a seismograph will be magnifying and recording visually the vibration present in the exhibit hall and vicinity.

VICTAULIC COMPANY OF AMERICA

Intends to exhibit its standard line of couplings, fittings, tools and accessories for grooved and plain end pipe. The Plain-lock method of connecting standard weight plain end pipe with mechanically locked couplings and use of Full-Flow fittings for directional changes and take-offs will be featured. This method eliminates pipe end preparation, and uses full wall thickness of the pipe.

WATT CAR & WHEEL CO., THE

Will use photographs and blueprints to show the company's latest version of large capacity mine cars. Plenty of chairs for Coal Show visitors to relax in and get the weight off their feet will be on hand.

WEATHERHEAD COMPANY, THE

Exhibit will feature products for the coal industry including forged steel pipe fittings, stainless steel fittings, plastic tube fittings, tube working tools, hose ends, split flange adapters, and air service components and services for assembly of heavy duty hose.

WEDGE WIRE CORP.

Intends to display Wedge Wire screen in different sizes and profiles and will feature its new Poly wire and WT profiles.

WELLMAN-LORD ENGINEERING, INC.

A new flotation cell reported to give better recovery over other types will be demonstrated. The cell will be fabricated of Plexiglass so that the action inside the cell can be observed.

WELLMAN CO., THE S. K.

Will exhibit the world's largest Velvatouch Feramic clutch plate in motion. Also to be displayed are brake linings for heavy-duty on and off the highway applications, and heavy-duty clutch plates and facings for tractors, trucks and deep mining equipment.

WEMCO, A DIVISION OF WESTERN MACHINERY CO.

Will feature a full-sized production model of a new vibratory centrifuge dryer, painted and arranged so that major working elements may be demonstrated and inspected. In addition, a gallery of flotation and heavy media separation equipment photos will be presented in a conference-relaxation area. There will also be cutaway models of a Torque-Flow pump and a laboratory flotation machine on exhibit. As a service to delegates, a message center where notes can be posted for friends and business acquaintances will be provided.

WERCO STEEL CO.

Is going to exhibit a Tornado impact crusher and will emphasize its maintenance and replacement part features. The company will also display its woven wire screens, perforated plate and alloy steel castings.

WEST ELIZABETH LUMBER CO.

Will stress the advantages of using Wolmanized treated timber products and will display pressure-treated mine ties, timber sets, cribbing and lumber.

WESTINGHOUSE ELECTRIC CORP.

Display will contain mining type motors, gearing and controls, and an Ignitron portable rectifier. The exhibit will stress maintenance, repair and service.

WEST VIRGINIA BELT SALES, INC.

Will feature PVC mine conveyor belting in 1000-ft rolls, and on an operating conveyor. Also to be shown are samples of various types of vulcanized pulley and idler lagging.

WHITMORE MANUFACTURING CO.

Special formula lubricants, for all types of service including those for open gears, cams, dipper sticks, enclosed gear cases, wire rope, hydraulic units, bearings, speed reducers, torque converters, and chains will be exhibited by Whitmore.

WINTER-WEISS CO. PORTADRILL DIVISION

Will display a truck-mounted rotary drill powered by an auxiliary diesel engine and equipped for either conventional air drilling or down-the-hole rotary percussion drilling. The drill is of unitized construction and while designed primarily as a blasthole drill is adaptable for use as an exploration tool.

WIRE ROPE CORPORATION OF AMERICA, INC.

Will feature Mr. Brown the mechanical talking bear, which is the trademark of the company's product line. Mr. Brown will tell people about Brown Strand wire ropes and slings. Part of the display will consist of a map showing warehouse service locations.

YOUNGSTOWN SHEET & TUBE CO., THE

Intends to exhibit VT1 mine roof bolts, standard steel pipe, Yoloy high strength steel sheet and plate, galvanized sheet, conduit, and Fibercast epoxy resin pipe.



Remember!

**There won't be
another Coal Show
until 1964.**

**You can't afford
to miss this one!**





A field of crown vetch on graded banks illustrate the plant's luxuriant growth and attractive blossom. Note the highwall in the background

Crown Vetch as an Aid to Strip Mine Reclamation

Hanna Coal Co. has pioneered in the use of crown vetch—a perennial legume with superior ground covering ability and soil building habits

By C. H. J. BREEDING
Field Director
Ohio Reclamation Association



It would be difficult to imagine any erosion on this hillside with its mat of crown vetch. The hives in the foreground indicate that the blossom is used by bees for producing honey

WHAT everyone directly responsible for the reclamation of strip mine lands has been searching for is a plant that will establish itself in one season, form a protective cover, yield a merchantable crop, rebuild the soil, and look pretty. Whether any such plant will be found is questionable, but the search goes on. The subject of this report is crown vetch; while it does not meet all of these requirements, it meets many of them.

Soil Holding and Ground Covering Properties Underscored

Crown vetch, *Coronilla varia*, is a perennial legume with a heavy, branching root system that is deeply penetrating. It seeds profusely from mid-June until September and also spreads by strong fleshy rhizomes growing to a length of ten feet or more. Once established it maintains a solid green mat of foliage during the entire growing season. It blooms from June through August and is extremely attractive with its pinkish-white to violet blossoms. As the clovers and alfalfa, it is a soil builder and soil nitrogen fixer.

The plant is a native of Europe and has naturalized in many places in the eastern half of the United States. The particular strain with which this article treats is the Penngift Strain, so named by its discoverer and developer, Dr. Fred V. Grau, who found it growing on a field in Berks County, Pa., on the farm of Robert Gift. Dr. Grau took seed and crowns to his farm in Centre County, Pa., where he developed techniques of culture and seed harvesting, and where he produces seed for market.

The Pennsylvania State University and the Pennsylvania Department of Highways conducted experiments on the plant's use in slope control on highways in 1947 and 1950. They were enthusiastic over the results obtained and felt it equal to the best of any other type of vegetation used for highway erosion control. A detailed account of their findings is available in Station Bulletin 576. Much other information is available from Dr. Grau at Grasslyn, P. O. Box 177, College Park, Md.

Superior to Other Cover for Calcareous Spoil Banks

There is a wide difference of opinion about its value as livestock forage and the Ohio Agricultural Experiment Station is currently conducting experiments on its proper management for pasture and its palatability for livestock. Dr. Diller, head of reclamation research at the station, has this



Fibrous roots break down the bank material into soil and anchor it firmly in place

to say about its use on strip mine banks; "field observations have shown that crown vetch is superior to other known herbaceous cover for the calcareous spoil banks in eastern Ohio."

The Ohio Reclamation Association made extensive seedings on widely differing types of strip mine banks, covering the whole mining area, in the spring of 1959. It is as yet too early to report any significant results from these seedings but they are being closely observed and the findings will be reported. This points up the main disadvantage to the use of crown vetch; it generally takes three years to get a good stand. This would seem to be more than offset by its superior ground covering ability and soil building habits. Also, its use as yet has been limited to the calcareous banks in Harrison and Belmont Counties in eastern Ohio, and pending information from the above seedings, its potential on other type material of a more acid nature is unknown.

Hanna's Experience With Crown Vetch

Hanna Coal Co., operating in the limestone area of eastern Ohio, through its reclamation manager, Edwin Mills, has pioneered in the use of crown vetch, and has seeded extensive areas over the past five years. Mills has seeded the vetch in varying amounts and with various grasses and other legumes in arriving at the best method of establishment and the most rapid. All of the seedings the company is now making on calcareous banks contain crown vetch. The company maintains a cattle herd of close to 1000 head and has gotten gains of up to two lb per day on test plots of crown vetch. However, it is its spectacular soil holding and ground covering properties which are most valuable; if no steer ate one mouthful, crown vetch would still have served its purpose.

SIZE CONSIST

judged most important coal property for combustion performance

COAL PROPERTIES SIGNIFICANCE CHART FOR COMBUSTION PERFORMANCE

	S.R.	M.R.	STOKERS		P.F.	Cyclone
			T.G.	S.S.		
1. Size consist (as fired)	V	I	I	V	V ¹	V
2. Moisture ²	M	M	N	M	V	M
3. Caking Index ³	I	I	V	M	N	N
4. Ash Fusibility	I	I	M	M	I	V
5. Grindability	N	N	N	N	V	N
6. Friability	M	M	M	M	N	N
7. Volatile Matter	M	M	M	M	I	M
8. Fixed Carbon	N	N	N	N	M	N
9. Ash Content	M	M	M	M	M	M
10. Calorific Value	N	N	N	N	N	N
11. Ash Viscosity	M	M	M	M	I	V
12. Ash Composition						

—See Footnote 4—

FOOTNOTES:

¹ Degree of fineness is a better term for P.F.

² Surface moisture is more critical than inherent moisture. Moisture is very important from the standpoint of plant flowability.

³ Some engineers are attempting to use the F.S.I. as an index of the degree of caking.

⁴ Ash composition is very important as it affects fireside fowling, but not important to combustion.

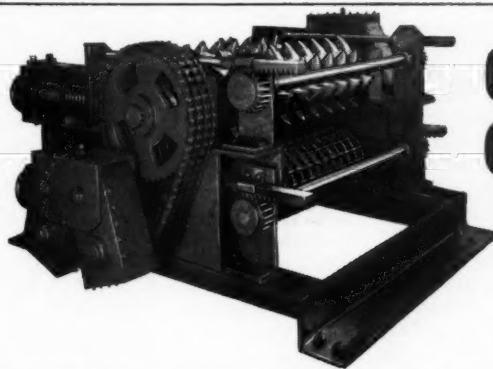
RATING CODE:

V — Very important

I — Important

M — Minor importance

N — Little or no importance



GUNDLACH CRUSHERS

provide greatest uniformity of SIZE CONSIST

Coal Utilization, in a survey, asked power plant operators to rate thirteen properties of coal as being very important, important, of minor importance, or of little importance. The plants participating were fired by single or multiple retort underfeeds, travelling or chain grates, spreaders, pulverized fines or cyclones.

Without exception the operators of every type of firing device rated size consist as very important or important. No other coal property even approached size consist in importance in their opinion.

Let a Gundlach Crusher prove to you through a crushing and screening test at your mine that it provides the greatest uniformity of size consist. Your customer benefits by control of top size... less fines... less unburnt coal in ashes... more BTU output per ton... lower ash handling costs... greater overall utilization.



T. J. GUNDLACH MACHINE CO.

P. O. BOX 283 • BELLEVILLE, ILL.

Division of J. M. J. Industries

Underground Ammonium Nitrate Blasting

Use of ammonium nitrate in small blastholes has been found to be safe, effective and economical

By ADOLPH V. MITTERER*

Manager
California Salt Co., and
BEN T. PHILLIPS, JR.
Mine Project Engineer
International Minerals &
Chemical Corp.

TIGHT competition in the potash industry makes it vital that international Minerals & Chemical Corp. explore all avenues for cost reduction and efficiency improvement. The company's test program with ammonium nitrate blasting shows that significant cost reductions can be made over conventional blasting methods with this new process. It has been shown to be safe, effective, and economical. Safety is the first consideration in its development. We believe that, as it has been developed at IMC, ammonium nitrate blasting presents fewer hazards than conventional blasting. To illustrate the important cost savings which can be obtained with ammonium nitrate, consider this tabulation of comparative blasting costs for a typical mining face.

Material Cost for Typical Mining Face		
	Conventional Blasting	AN Blasting
Dynamite	\$14.65	\$ 2.72
AN Plus Oil		3.83
Caps	5.81	5.21
	(12' wires)	(8' wires)
	\$20.46	\$11.76

By the spring of 1958 ammonium nitrate had become of significant importance in open pit mining, and the practice is now used almost universally. However it was generally

thought that the material could not be detonated reliably in blast holes smaller than four-in. in diameter and therefore it did not seem to be suitable for use underground. Noxious fumes also were thought to be a problem. The first use of ammonium nitrate underground was at the Clayton Silica Co. in Clayton, Iowa, where blasts were detonated satisfactorily in 2½ in. diam holes. Subsequently, the Eagle Picher mine at Picher, Okla., began to use nitrate in 2-in. and 2½-in. blast holes.

Testing Program Begun in 1958

In the summer of 1958, IMC personnel visited these two mines and, as a result, the company decided to test the process at Carlsbad. In July and August, 13 test detonations were set off to demonstrate the feasibility for using ammonium nitrate underground in small-diameter blast holes. Since, these first tests were designed solely to demonstrate the feasibility of using ammonium nitrate in potash, some simple means was required for utilizing the material in standard blasting rounds.

Ammonium nitrate cartridges were made by filling 1⅞ in. by 12½ in. Kraft paper tamping bags with AN-

fuel oil mixture. The filled bags measure 1⅞ in. in diameter by 12 in. in length. The diameter is the same as the standard 1⅞ in. dynamite cartridge, but the AN stick is about half again as long as the 8-in. dynamite stick. The bags were filled by the use of a small hopper made from an old grease drum with a valve at the bottom. This device was slow but it served adequately for the initial tests. Packing the nitrate-oil mixtures into cartridges was one possible way for substituting the new material in our blasting practice.

In the first tests, these cartridges of ammonium nitrate were substituted stick for stick for dynamite in each blast hole. Test detonations ranged from 50 to 86 percent ammonium nitrate in the total charge. Reliable detonation was found at the ratio of about 80 percent ammonium nitrate. In general, fragmentation was found to be good and blasting fumes were satisfactory.

Blast holes were loaded in the following manner: An ammonium nitrate cartridge was placed in the back of the hole as a cushion followed by an 8-in. primer stick consisting of a stick of 45 percent bulk strength dynamite and a millisecond-delay electric blasting cap. Then three more

* Formerly mining engineer, International Minerals & Chemical Corp.

ammonium nitrate cartridges were added and tamped well. Another stick of dynamite was added, followed by the remaining three or four ammonium nitrate cartridges and then the hole was tamped again.

In these tests the powder factor was purposely held higher than in conventional blasting. Fragmentation was

generally as good as dynamite and therefore this round was used as a standard round in subsequent fume tests. Several other test rounds were fired, using Primacord, higher velocity dynamites, and with other AN to dynamite ratios, but none gave as reliable results as the round just described.

Advantages of Using Air-Placed AN

Because of the favorable results in the initial test blasts an alternate method for handling the nitrate was investigated. This involved blowing the bulk material into the blast hole with a pneumatic placement machine. Similar machines have been used successfully in open pit blasting. A test unit was brought into the Carlsbad mine, and it was found that air-placed nitrate offered several important advantages over cartridge material.

Air-placed nitrate completely fills the blast hole to a density higher than that which can be obtained by tamping. This results in improved coupling with the rock and thereby greatly improved efficiency of the blast. In fume tests it was found that a further advantage of air-placed material is that the fume characteristics generally are superior. But at the same time it was recognized that pneumatic placement machinery could be a source of static electricity and this in turn could create a problem with electric blasting caps. This possibility still is under investigation but the evidence indicates that there is no static hazard created by the air placement process.

In September and early October of 1958, 12 additional test rounds were shot with varying ratios of nitrate to dynamite to gain further experience in the new process. A further testing program was proposed, but before it was begun the company sought and received the approval of the State Inspector of Mines to carry on with the experiments.

Bulk AN Superior to Bagged Type

In January 1959 a cooperative test program was organized with the U. S. Bureau of Mines, U. S. Geological Survey, and the New Mexico State Inspector of Mines for detailed examination of the fume characteristics of several tests and reference blasts. The air placement method had proven to be practical and therefore it was incorporated into the test program along with tests of cartridge material.

Because of limitations in the Bureau of Mines Laboratories, the program was broken down into two series. Each test blast required the gathering of 25 or more gas samples by USBM and IMC personnel. Reference blasts were shot with a gelatin dynamite chosen by the Bureau to represent the optimum fume characteristic. Similar blasts were detonated with ammonia dynamites of two different manufactures, both of which were standard production materials



Incorporated in the powder truck is a high-capacity rotary air compressor operated through an automotive magnetic clutch. The compressor operates continuously at low pressure



Height of the powder truck was restricted to 50-in. so that it could operate anywhere in the mine. The unit is equipped with a 20-hp air-cooled diesel engine and Bureau of Mines approved scrubber



In a typical 28-ft mining face, 1 1/2 in. blastholes are drilled in eight vertical rows spaced 48 in. apart. The face is undercut to a depth of about 8 1/2 ft with a universal undercutter

for potash.

Bagged nitrate and bulk nitrate tests were run using various dynamites as primers. Duplicate tests were run where possible and all conditions were kept uniform throughout the test series. An interpretation of the results is shown in figure 1.

Bulk nitrate was found to be significantly more efficient in rock breakage than were bagged material or any of the reference blasts. The air-placed material completely filled the blast hole. This improved fragmentation by increasing the powder factor and also through superior coupling to the rock through the elimination of air spaces in the explosive column.

Bulk nitrate also has superior fume characteristics provided that it is primed with a dynamite which has good fume characteristics also. Bagged nitrate is shown to be poorer in breakage characteristics and also generally higher in fume production.

Safety Stressed in Bulk Loader Design

When all the results of the tests were considered, and in view of the cost advantages, a decision was made to go ahead with developing a bulk loading process for use throughout the mining operation. In the summer of 1959 work was started toward designing and building specialized machinery for use in low height mining operations.

The test machine for air placement was mounted on a trailer and air was supplied from an electrically driven reciprocating compressor. This arrangement was inconvenient and clumsy to operate. Furthermore, it was felt that a significant safety hazard was created by using electrically powered equipment. Therefore, design work was pointed toward developing a diesel powered, self-propelled air placement unit.



Flow of ammonium nitrate into the blasthole is controlled by a one-in. ball valve on the charging tube. Initial flow of air through the tube cleans the blasthole and as the column of ammonium nitrate builds up the tube is withdrawn using a slight tamping action

A five-ton diesel underground utility truck was purchased and a low-profile air placement vessel mounted on it. Preliminary designs indicated that it might be possible to charge the receiver with sufficient pressure so that a face could be filled with nitrate without the necessity for operating a diesel engine. The first unit was constructed with this in mind. However, tests showed that there was not sufficient receiver capacity available and that, for it to work, operating pressures in the receiver would have to exceed 150 psi. This method therefore was abandoned because of the safety hazard from possible rupture of high pressure air receivers.

The next development, and the method now used on all ammonium nitrate machines, was to put a compact, high capacity, rotary compressor on the machine. This compressor

operates continuously but at very low pressure. It imposes considerably less load in the engine than the reciprocating compressor operating at high pressures, and therefore it is unlikely that it will create any hazards from exhaust gas due to overload. The compressor is operated through an automotive magnetic clutch that can be readily engaged or disengaged by the operator.

All the equipment is mounted on the diesel truck together with a cap box and a box to carry a limited supply of dynamite for priming. Blasting wire, blasting machine, danger signs, galvanometer, and fire extinguisher are all mounted on the vehicle also. Over-all design height is restricted to about 50 in. so that the unit can operate throughout the mine. The truck is equipped with a Bureau of Mines approved scrubber and 20 hp air-cooled diesel engine.

One air placement machine is available for use in each production and development section. As the sections were changed over from conventional blasting to ammonium nitrate, each powderman was personally instructed in the use of the technique by a member of the mine engineering staff. At least two complete shifts were spent instructing each man. Supervisors were instructed in the operation of the machine also.

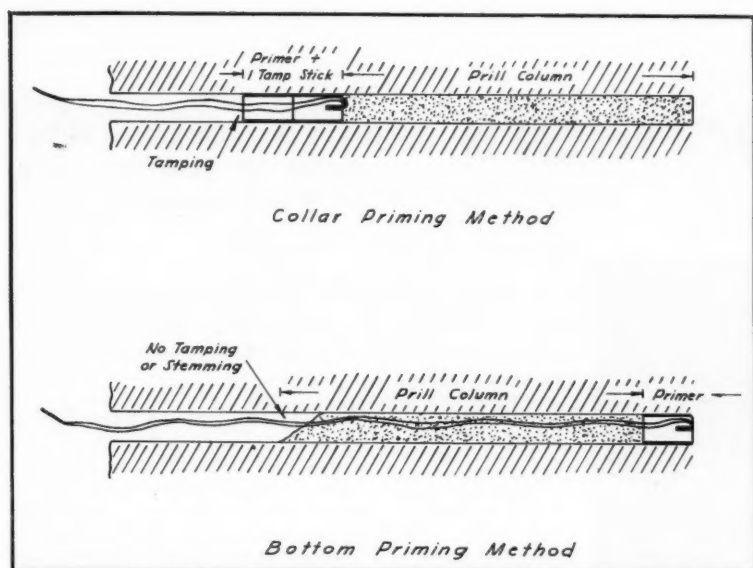
No. 2 Diesel Oil Used for Sensitizing

At the present time, the ammonium nitrate is sensitized by the addition of three quarts of No. 2 diesel oil to each 50 lb sack. The material is allowed to stand for at least eight hours before being used. An addition of the excess oil insures that all prills will be adequately sensitized and the excess oil drains out through the bottom of the sack. This creates something of a housekeeping problem, but it is the best method we have found for insuring that material oiled in the sack is adequately sensitized. Frequent quality checks of the material show that material so oiled and allowed to drain for eight hours has an oil content between five and six percent.

This method of sensitizing is not entirely satisfactory and work is continuing on plans for a central mixing installation where all nitrate used in the mine can be mechanically mixed and packaged for movement into the working areas. Central mixing offers some other advantages as well. Thorough mechanical mixing followed by an appropriate period of aging makes the sensitized material very free flowing. Our tests also show

Description	Blast Effectiveness Rated	Actual Total Powder Factor	Apparent Noxious Gas Production (Cu ft per lb (Not corrected to STP))	
			NO ₂	CO
Gelatin dynamite	Normal	0.74	0.031	0.12
Ammonia dynamite B	Normal	0.80	0.114	0.098
Ammonia dynamite C	Normal	0.69	0.040	0.109
Bagged AN-dynamite B	Poor	0.56	0.059	0.132
Bagged AN-dynamite C	Poor	0.70	0.046	0.138
Bulk AN-dynamite B	Superior	1.00	0.085	0.086
Bulk AN-dynamite C	Superior	0.98	0.043	0.060

Fig. 1. Summary of blasting fume tests



Collar priming is used at present to circumvent any potential hazard from electrostatic generation, but test work on the more efficient practice of bottom priming continues

that greater efficiency and probable improvement in fume characteristics will result from aging the material for some period longer than eight hours. Quality control will be better and the entire process will be made more trouble-free by eliminating problems from caked material.

Face is Undercut to 8½ Ft Depth

A typical mining face in potash is 28 ft in width and ranges from five to eight ft in height. Each face is undercut over the full 28 ft width to a depth of about 8½ ft using a universal undercutter. Blast holes are drilled with a hydraulic-powered, two boom, jumbo drill using auger steel and tungsten carbide bits. The 1½ in. blast holes are drilled in eight vertical rows spaced 48 in. on centers. Two, three, or four holes are drilled in each row, depending upon face height. Cut holes look down at 15° and are drilled so as to bottom about six in. above the back of the cut. Top holes look up slightly and the remaining holes are fanned out vertically to distribute the burden.

When the ammonium nitrate placement unit is moved into the face the compressor is switched on and pressure is allowed to build up to 18 to 20 psi in the loading hopper. The material flows into the blast holes through a 50 ft length of one-in. ID neoprene hose and a ten ft length of 1¼ inch OD polyvinyl chloride rigid plastic tube. Flow is controlled by a one in. ball valve located at the end of the charging tube.

The tube is inserted all the way to the back of the hole and the ball valve is opened fully. The initial flow of air through the tube cleans out dust and cuttings in the blast hole, and as the column of nitrate builds up, the tube is withdrawn slowly, using a slight tamping action. With practice, the hole can be filled to within three ft of the collar, with a dense, uniform column of ammonium nitrate, in less than 15 seconds, and very little material is lost by blow back. Blast holes so loaded each contain about four lb of AN or about 100 lb in the total face. After the powderman is acquainted with the equipment, a 24-hole face can be loaded easily within 15 minutes.

Collar Priming Avoids Possible Electrostatic Hazard

In present practice collar priming is used in order to circumvent any potential hazard from electrostatic generation. Further work is being done on this, and it is felt that within a short time the change over can be made to the more efficient practice of bottom hole priming. Collar priming requires careful attention to drilling and design of the delay pattern if cut-off or decoupled holes are to be avoided. Up to four millisecond delay periods are used, depending on face height. The initial interval is 135 milliseconds; subsequent delays are in 35 millisecond intervals. In addition, the end or corner holes are sometimes delayed an additional 35 milliseconds to reduce overbreak and improve

shear on the ribs.

Cut holes are fired first at zero delay, then the breast holes plus the end holes are fired at 135. Finally the top holes and then the corners. The resulting muck pile is very well broken and in general quite compact. It is unusual for material to be thrown more than 50 ft from the face. Only occasionally are boulders larger than 36 in. found and these usually can be traced to faulty drilling or cutting.

The primer stick for each blast hole consists of 1½ in. diam by 8 in. long stick of 70 percent strength ammonia dynamite into which is inserted a millisecond delay electric blasting cap. The priming stick is placed in the nitrate-filled blast hole and is followed by another stick of dynamite to act as a cushion for tamping. The hole is tamped well and the blasting caps are wired in series. Each face which has been prepared for blasting is shot independently at the end of the shift with the use of a 320 volt capacitor-discharge blasting machine.

Nature of Future Work

Testing and development of ammonium nitrate blasting is continuing. These developments will be concentrated along two general lines: first, to demonstrate that bottom hole priming is practical for use with air-placed ammonium nitrate; and second, to achieve central mixing with its benefits of quality control and consistent aging, which will help to improve the effectiveness of AN blasting. Tests are also being carried on to find the optimum aging period for maximum efficiency.

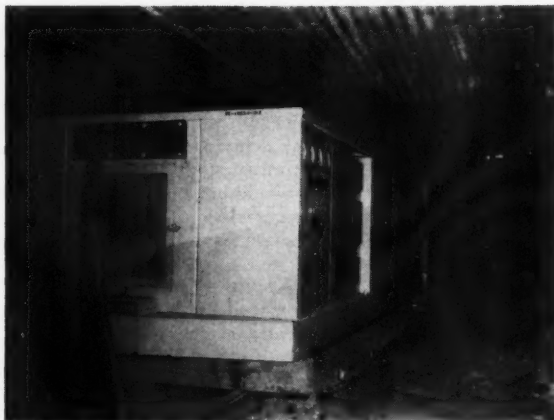
In the test round and in the adaptation of the process to production use, overall powder factors have been increased in order to be certain that fragmentation will be good while operating personnel become acquainted with the process. As techniques improve, and with the results of further development, we expect to bring powder factors back to the low point reached with standard dynamites, and possibly even below.

This pioneering work by International Minerals & Chemical in cooperation with the Bureau of Mines and the New Mexico Inspector of Mines has resulted in the development of a useful new technique for underground blasting. It has been demonstrated that ammonium nitrate can be utilized safely and effectively in small blast holes with recessive amounts of blasting fumes. Important cost savings will be realized from this work not only by IMC but by the mining industry generally.

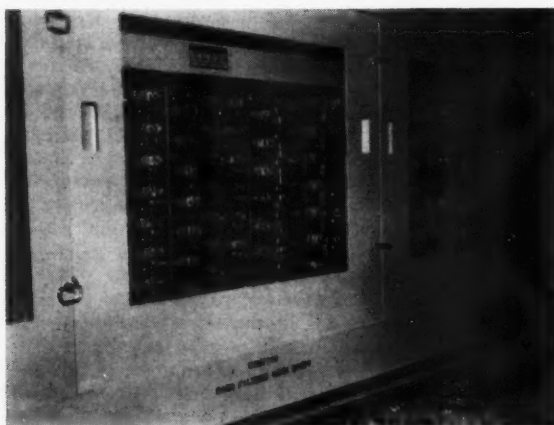
Silicon Rectifiers

Ireland mine's experience with this equipment underscores its economy, reliability and simplicity

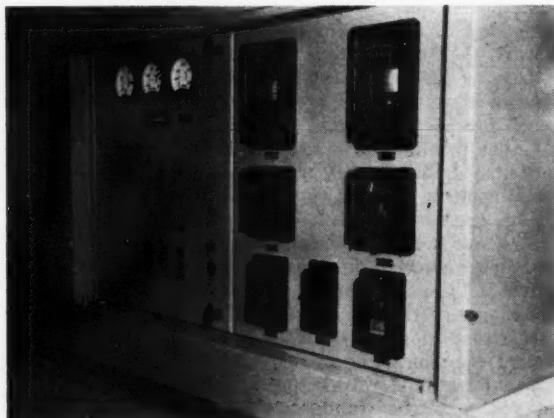
By C. L. SARFF
Chief Engineer
Ireland Mine, Hanna Coal Co.



No doors or fire-proofing are needed in this typical underground installation of a silicon rectifier. Note that the place is roofed with corrugated steel sheets



Buss connections to diode trays. The trays can be changed in less than ten minutes



Simplicity of the control panel is illustrated. Any mine mechanic with some electrical knowledge can maintain and repair the control circuit

TWO and a half years ago the Ireland mine of Hanna Coal Co., Division of Consolidation Coal Co., had two d-c conversion units in service—a 500-kw Hewettic rectifier on the surface, and a 400-kw ignitron rectifier underground. The growth of the mine and expansion indicated that the company would need another 500-kw unit in nine months and a fourth unit in two years.

The Hewettic rectifier and the ignitron were giving very good service; however, news was just reaching the mining fields of the outstanding performance of silicon rectifiers in the chemical industry. Hanna decided that a thorough study was in order before making a purchase. This study showed that the silicon unit had certain advantages.

Simplicity of Unit—One of the Deciding Factors

First, the initial cost of the unit would be much less than the cost of an ignitron and would be competitive with the Hewettic rectifier. The contract reached gave the company a price of \$80 per kw against \$110 per kw for the ignitron; putting it another way, the ignitron would cost 37½ percent more than the silicon rectifier.

Second, the simplicity of the silicon rectifier was one of its deciding factors in reaching a decision. It was evident from prints submitted that any mine mechanic with some electrical knowledge could maintain and repair anything that could happen to the control circuit. With 22 years of experience with ignitrons, the company has developed several electricians who take care of most of the maintenance; however, while failures are not frequent, there have been several failures in firing circuits which mine personnel have been unable to repair. Factory service men had to be called in and several shifts

(continued on page 91)

Radiation Control in Uranium Mines and Mills

Atomic energy has given us many benefits, but the energy given off by radioactive materials also has the power to damage living tissue. For this reason, radiation controls are necessary to protect personnel in the industry and the nearby population against potential radiation hazards

By R. G. BEVERLY
Administrator-Radiation Controls
Union Carbide Nuclear Co.

IN the uranium mining and milling phase of the atomic energy industry, the potential hazards from radiation are small compared to other phases of the industry. This is because only natural uranium is involved which, compared to enriched uranium and fissionable materials such as plutonium, is not very radioactive. Also, throughout most of the mining and milling operations an ore is involved which contains an average of only 0.25 percent uranium. Even after a concentrated product is prepared, which may average 75 percent uranium and which initially is free of other decay products, still only natural uranium with its relatively low radiation energy is involved.

Uranium and Its Decay Products

Uranium as it is found in nature consists of 99.3 percent U-238 and is undergoing a continual state of decay or change to isotopes and other elements. In so decaying, various types of radiation, largely alpha, beta, and gamma are emitted.

Uranium-238, the parent or source of one of three natural decay series, emits alpha radiation and decays to thorium-234 which in turn decays to uranium-234. Chemically these isotopes are identical but "atomically" they differ. In nature, we find only one part of U-234 for every 17,000 parts of U-238. This is because the U-234 is decaying away, or disintegrating roughly 17,000 times faster than U-238. The half-life of U-238, is 4½ billion years, roughly the age of the earth. The half-life of U-234 is 248,000 years.

Uranium-234 decays by alpha

radiation to thorium-230 which, in turn, decays by alpha radiation to radium-226. As far as is known, all uranium minerals contain one part of radium to 2,800,000 parts of uranium. Radium decays by more alpha emission to radon-222. Radon is quite different from other daughter products in the chain in that it is a dense radioactive gas. The half-life of Rn-222 is less than four days and it decays rapidly by alpha emission to polonium-218, often called radium-A, thence to lead-214 (radium-B), and bismuth-214 (radium C). The latter three nuclides are frequently termed radon daughters and unlike radon are solids.

The uranium-238 decay series is shown in table I. There are eight alpha-emitting isotopes in the U-238 chain, and six beta emitters. The more significant gamma emitters and measured energies in millions of electron volts are shown in the last column of the table. Details on branching of the chain in certain places and on radiation energies are contained in the literature.^{1,2,3}

Along with uranium-238 and uranium-234 found in nature is 0.715 percent of uranium-235. Uranium-235 is the only readily available fissionable material found in nature and, thus, is of great importance to the industry. It is also the parent of another disintegration series. Because of the relatively small amount of U-235 present in nature and because no separation of the uranium nuclides is made in the milling industry, it is of lesser importance than the U-238 series as it concerns radiation control in uranium mines and mills.

Table I. U-238 Decay Series
Abundance: 99.3%

Nuclide	Historical Name	Nucleus		Half-Life*	Major Decay	Gamma MEV
		Protons	Neutrons			
Uranium-238	Uranium I	92	146	4.49 × 10 ⁹ y	α	.05
Thorium-234	Uranium X ₁	90	144	24.1 d	β γ	.029-.100
Protactinium-234	Uranium X ₂	91	143	1.18 m	β γ	.064-.92
Uranium-234	Uranium II	92	142	248,000 y	α	.055
Thorium-230	Ionium	90	140	80,000 y	α	.068
Radium-226	Radium	88	138	1,622 y	α	—
Radon-222	RaEmanation	86	136	3,825 d	α	—
Polonium-218	Radium A	84	134	3.05 m	α	—
Lead-214	Radium B	82	132	26.8 m	β	.053 to .351
Bismuth-214	Radium C	83	131	19.7 m	β γ	.45 to 2.42
Polonium-214	Radium C'	84	130	1.6 × 10 ⁻⁴ s	α	—
Lead-210	Radium D	82	128	22 y	β	.0465
Bismuth-210	Radium E	83	127	5.0 d	β	—
Polonium-210	Radium F	84	126	138.4 d	α	—
Lead-206	Radium G	82	124	Stable	—	—

* y: years, d: days, m: minutes, s: seconds.

Alpha radiation (α) is of little concern with regard to external radiation as it is incapable of penetrating the dead outer layer of the skin. It is of concern when taken into the body in appreciable quantities, however, as the energy is adsorbed by the tissue near where it accumulates. The alpha emitter radium, for instance, concentrates in the bone and if in sufficient quantity may lead to depression of bone marrow activity.⁴

Beta radiation (β) which has a relatively short range in the air, usually not more than a few feet, presents an external radiation problem only when a person is quite close to the beta source. It can do damage in the body within a relatively localized area.

Gamma radiation (γ), when present in sufficient quantity, represents the most severe external radiation hazard as it is long range and is high penetration radiation. Within the body its energy is diffused and some gamma rays pass right out of the body. Various types of radiation and protection against each are discussed in a simplified and excellent manner by Brannigan.⁵

Exposure Standards and Protection Regulations

The International Commission on Radiological Protection (ICRP), which was established in 1925, has periodically issued protection recommendations.^{6,7} The National Committee on Radiation Protection and Measurements (NCRP) was formed in 1929 upon the recommendation of the ICRP and is managed by the National Bureau of Standards. The protection regulations under which the uranium milling industry operates were set forth by the U.S. Atomic Energy Commission in Part 20, Title 10 Chapter of the Federal Register "Standards for Protection Against Radiation," issued February 28, 1957. These regulations generally follow the recommended dose and exposure limits contained in Bureau of Standards Handbooks 52 and 59.^{8,9}

Following more recent ICRP and NCRP recommendations, Bureau of Standards Handbook 69 was issued June 5, 1959.¹⁰ A change to Part 20, Title 10, CFR was published in the Federal Register on September 7, 1950, and went into effect on January 1, 1961.

The maximum permissible concentrations in Part 20 amended and external radiation doses as interpreted by others from Part 20, and which are of most significance to the uranium mining and milling industry,

are shown in table II.

With regard to radon daughter concentrations and their measurement and control in uranium mines, it has been stated: "Sufficient biological data are not available to determine finally a maximum permissible concentration for radon daughter products. It is hoped that studies now in progress will furnish these data. In the interim, a working level of 1.3×10^5 Mev of potential alpha energy per liter is suggested for radon daughter products (RaA, RaB, and RaC'). This amount of energy will be released by the decay of 100 micromicrocuries of each of these elements through RaC'. On the basis of present information, this level appears to be reasonably safe and not unduly restrictive to mining operations.¹¹ The working level of 3×10^{-7} $\mu\text{C}/\text{ml}$ (300 micromicrocuries per liter) has been in use by most uranium mining companies and by the U.S. Public Health Service, for a number of years. It should be pointed out that the Part 20 regulations have not been applied to uranium mining operations, other than those on government property.

Monitoring and Sampling Equipment

External radiation levels commonly found in uranium mines and mills are relatively low, ranging between less than 0.01 milliroentgen (mr) per hour to two or three mr/hr in ore stockpile areas. It has been the experience in Union Carbide's mills that most operating areas show less than one mr per hour external radiation levels. Geiger or scintillation equipment with scales ranging up to five mr/hr are required. Many companies also use film badges for estimating accumulated doses to personnel. Badges should be worn for two- or preferably four-week periods to obtain useful results, as the majority of one-week badge results will be less than 50 mrem for beta or gamma exposure. More elaborate external radiation equipment is normally unnecessary as, with extremely few exceptions, there is no high source of radiation in this phase of the industry.

Equipment in use for measuring airborne uranium concentrations in mines, and mills will vary according to the type of survey being made. Air samplers with capacities of 15 to 30 liters per minute are in common use. With sampling times of 10 to 20 minutes, it is thus possible to obtain quantities of ore dust or concentrate on the filter media that are well within accurate fluorimetric assaying ranges at concentrations of 0.1 of the

Table II. Limits of Most Concern to Uranium Mining and Milling Industry

(From Part 20, Amended 12-30-60)

Airborne natural uranium in restricted areas	$\mu\text{C}/\text{ml}$
10-hr week basis—for ore dust	25×10^{-11}
—for uranium concentrate	6.0×10^{-11}
Airborne natural uranium in restricted areas	
Based on 168-hr occupancy—for ore dust	8×10^{-12}
Liquid effluents released to unrestricted areas	
Radium-226	1×10^{-6}
Thorium-230	2×10^{-6}
Natural uranium	2×10^{-6}
$\frac{\text{conc. Ra-226}}{1 \times 10^{-6}} - \frac{\text{conc. Th-230}}{2 \times 10^{-6}} - \frac{\text{conc. U-nat}}{2 \times 10^{-6}} \leq 1$	
Radon daughter concentrations in restricted area	3×10^{-7}
Permissible Dose from External Radiation	
(For persons over 18 years of age in restricted area)	
Gamma radiation, whole body dose	
Quarterly dose not to exceed*	1.25 rems
Beta plus gamma radiation, skin dose	
Quarterly dose not to exceed	7.5 rems
Personal Monitoring Required if	
Quarterly gamma dose exceeds	0.313 rems
Quarterly beta plus gamma exceeds	1.875 rems

* Quarterly dose of three rems permitted if accumulated occupational dose is taken into consideration.

Part 20 maximum permissible concentrations. Impinger samplers have also been used in collecting airborne samples. Battery-operated samplers or those using the aspirator principle are convenient in mines and in locations where no electrical outlets are available. For evaluation of particular areas or specific operations, continuous tape-type samplers and sequential samplers are useful.

In unrestricted or off-site areas, the use of higher volume samplers, 500 to 1000 liters per minute, eliminates the extended sampling times which would be required to obtain sufficient quantities of uranium on the filter media for analytical accuracy. With a total sample volume of 25,000 to 50,000 liters fluorimetric accuracy can be obtained at 1 percent of the MPC (maximum permissible concentration). The use of standard air sampling equipment^{12,13} in most cases is applicable to the uranium milling industry.

Air sampling in mines for radon daughter concentrations is usually done with 10 to 25 liters-per-minute, battery-powered samplers using five to ten-minute sampling periods. The alpha activity of the radon daughters collected on the filter media is then measured with an alpha counting field



Installing 20-in. polyethylene vent tubing for secondary ventilation in haulage way of uranium mine in the Uravan Mineral Belt in western Colorado

instrument after a measured interval of time. It is periodically necessary to calibrate the field counter against a proportional counter.¹¹

For sampling liquid mill effluents, either hand or automatic samples are required. It has been common to assay effluent samples for uranium and radium-226. Uranium assaying facilities are available at the mills and about one-third of them have installed radium analytical and counting equipment. Numerous commercial laboratories will make radium determinations.

Adequate Ventilation Essential in Mining Areas

Measurement and control of radon gas in underground uranium mines is by far the most important part of radiation control programs in the uranium mining field. Controlling the radon gas concentration also controls the concentration of radon daughters, Po-218, Pb-214, and Bi-214, which can be deposited in the lungs when miners breathe air contaminated with radon gas. The gas enters mine atmospheres by diffusion from ore bodies and, although only slightly soluble in water, can be carried by ground water.

One curie of radon weighs approximately 6.5 micrograms. The recommended working level of 3×10^{-7} $\mu\text{C}/\text{ml}$ is equivalent to 2×10^{-9} μg Rn-222 per liter of air. Only because it is possible to measure the radon daughters by their radioactivity can their concentrations be measured at all. The extremely small quantity which is measured is illustrated by the fact that it would only take approximately two lb of radon gas to raise the atmosphere of the State of

Nevada to a height of one mile to the recommended working level.

Today, essentially all producers frequently sample working areas in the mines for determining radon daughters. By large air dilution at the working face it is possible to lower radon daughter concentrations below the working level. Adequate ventilation is achieved by installing large ventilation fans, secondary circulation fans, vent holes and vent tubes for air distribution. Bratticing off old workings and utilizing natural ventilation to its best advantage are used to augment ventilation and reduce radon concentrations.

If miners eat in the mine, well ventilated areas should be provided. Mine water, if used for drinking, should be checked for radium and radon content.

Airborne dust control is also a consideration in mines which must be evaluated, particularly if the ore is of a dry and dusty nature. Mines in wet formations have little or no dust problem.

External radiation in mines has been evaluated by some companies. Union Carbide Nuclear Co. made a study in one mining area using film badges on a representative group of mining personnel including supervisors and all classification of miners. Weekly badge exposures and 13-week cumulative exposures for gamma and beta radiation were all well below the most recent recommended maximum exposures of five rem per year, or approximately 100 mrem per week. Scintillation counters have also been used to determine the range of external radiation in mines. Except for short periods while mining an occasional high grade ore pocket, external radiation in uranium mines need be of little concern.

Problem in Crushing and Sampling Plants is Airborne Dust

Crushing, storage, sampling and weighing of uranium ore prior to the time it enters the wet processing portion of a mill normally result in the generation of some airborne dust. By properly designed, installed and maintained dust collection equipment, high airborne concentrations can be avoided.^{14,15} However, it is necessary to maintain close surveillance of this section in most mills by frequently sampling airborne dust and keeping dust collection equipment in an efficient operating condition.

Part 20 regulations have set a maximum level for airborne uranium concentration in the mill areas where ore dust is involved of 2.5×10^{-11} microcuries per milliliter of air for a

40-hour per week exposure. For 48-hour work weeks, this must be reduced to 2.1×10^{-11} . Where uranium concentrate is of concern the limit is 6×10^{-11} μC U-nat./ml for a 40-hour week.

Areas in crushing and sampling plants which are occupied by workers are sampled for airborne dust at intervals frequent enough that representative airborne concentrations can be established. These samples may be of several types: general air samples, breathing zone samples which are taken near the operator's face while he is performing a particular operation, or process samples for locating the source of dust or efficiency of dust collection equipment.¹⁶

Dust Respirators Give Added Safety

If dust concentrations are found in excess of the limits in the regulations, it is necessary to calculate time weighted exposures for all job classifications which require presence of the operator in the area. This is done by making job studies to determine what percent of the operator's time is spent in each operating area. The time weighted exposure can then be calculated by adding together the various products of percent of time in the area and the average airborne uranium concentrations. The more objective approach is, of course, to reduce the dust to keep all areas below the concentration limits. This ensures that no operator could receive an exposure over the recommended limits.

For the more dusty operations in a



Taking a breathing zone air sample to determine airborne uranium dust in the sampling plant of Union Carbide's Uravan, Colo., mill

mill, it is often common practice to require operators to wear dust respirators. This gives an added safety factor in ensuring low exposure. Effectiveness is dependent upon an adequate program for fitting, cleaning, storage, maintenance, and filter replacement.

Areas should be posted with the proper airborne radioactivity area sign if the airborne concentrations exceed the limits or if concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25 percent of the amounts specified.

Wet Processing Areas Present Few Problems

Radiation control problems in wet processing areas are at a minimum, since they are relatively dust free and airborne uranium concentration can be expected to be low unless there is dust entering from other mill areas. External radiation exposure can be expected to be low. However, it is necessary to be watchful for the accumulation in mill processing equipment of daughter products, particularly the gamma emitting radionuclides such as Pb-214 and Bi-214. One mill found relatively high gamma radiation in the ion exchange section of the mill which was thought to be caused by an accumulative build-up of gamma-emitting daughters on the ion exchange resin.

The part 20 regulations require posting a sign, "CAUTION (Radiation Symbol) RADIOACTIVE MATERIALS," in each area or room in which over 33 lb of natural uranium is used or stored. Each container in which natural uranium is transported, stored, or used in quantities greater than 3.4 lb is to be similarly labeled. This regulation is not particularly appropriate for uranium mills as nearly every tank, vessel, pipeline, room and area would have to be posted. Most mills have applied for and been granted an exemption by the AEC from this regulation provided entrances have been adequately posted.

Precautions in Concentrate Areas

After wet precipitation of the uranium concentrate (yellow cake), it must be filtered, washed, dried, screened, sampled and barrelled. During the filtering and washing steps, the material is still wet. Concentrate is dried in many types of dryers including the rotating hearth calciners, continuous belt hot air dryers, and steam heated drum dryers. The product at this point contains 70 to 80 percent U_3O_8 and is a dry, easily fri-



As mine atmospheres are sampled through membrane filters, the radon daughters—solid decay products of radon gas—are collected on the filter. Afterward, a field alpha counter is used to determine the concentration of radon daughters

able material. If allowed to become airborne, it can create high concentrations of dust and cause loss of valuable product.

The AEC requires that all concentrates be minus one-quarter in. so as to ensure accuracy in the commissions sampling procedure. This usually necessitates reducing the dryer product in size and screening it through a quarter-inch screen. Unless carefully designed for dust tightness, this operation and the subsequent barreling can be the most significant dust source in a uranium mill.

For emphasis regarding the comparative levels of airborne uranium allowed, in a mill crushing area where a 0.25 percent U_3O_8 ore is being handled, the airborne limit of 2.5×10^{-11} $\mu\text{C U/ml}$ is equivalent to approximately 1000 grams of airborne ore dust per million cubic feet of air. In yellow cake processing areas where a 75 percent U_3O_8 product is involved, the airborne limits would be equivalent to only about 7 grams of concentrate per million cubic feet of air. Thus, it has been necessary to go to elaborate means to contain the uranium concentrate.

Numerous types of enclosed conveyors, dust collectors, and clean-up equipment are used by the uranium mills. Complete enclosure of the product drying, sampling, and barreling area minimizes the chance for airborne concentrate to be carried into other processing areas. Cleaning of the areas is most efficiently accomplished by washing down with water and/or using vacuum equipment.

It is often necessary to take more air samples in the product area than

in other mill areas. Breathing zone samples where operators are performing routine operations such as sampling drums of product and changing drums are useful in evaluating worker exposure to airborne material. Most mills require the use of dust respirators for operators in the area, again as an added precautionary measure. Others rotate employees on various jobs to reduce the time they are in areas of higher dust concentrations.

Exposures Determined with Film Badges

Because daughter products of uranium are not present in significant quantities in freshly precipitated concentrate, only uranium is of concern in airborne samples. For the same reason, freshly precipitated concentrate has little gamma activity and although a much higher grade material than uranium ore is involved, external radiation levels are not high. On aging, however, beta and gamma-emitting daughters continue to grow in.

Through film badge studies of all types of mill operators, it has been found that higher beta and periodically higher gamma badge exposures have resulted from those worn by yellow cake operators than by other mill operators. They are normally well below the recommended maximum routine exposure, but may occasionally reach 25 percent of the regulation level, above which level the regulations require personal monitoring.

Certain phases of the industry beyond the milling of uranium ores use extensive urinalysis evaluation programs to estimate the internal radiation exposure and body burden from intake of uranium.¹⁶ Periodic uranium assays on urine samples have been helpful in determining the non-existence of a body burden, variations in intake by different operators, and the effect of personal cleanliness and hygiene on uranium intake.¹⁷ Although there have been varying opinions on the reference level or recommended protection guide to use in evaluating uranium concentration in urine, the level of 50 micrograms per liter is commonly used.

In the concentrate areas, regulations prohibiting eating, smoking and food storage are recommended. Most mills conduct an educational program to promote an understanding of radiation, important phases of operating procedures to do with control measures and to encourage personal hygiene in minimizing the opportunity

of body intake by ingestion or inhalation. The programs have included written material and informal talks. The AEC publication on "Living with Radiation" contains useful material for these purposes.⁵

Radium in Tailings and Effluents

A typical uranium mill will discharge about a ton of solid tailings material for every ton of ore processed. Along with the solid tailings will be two to five tons of liquid effluents depending on the process used. They may be acidic, neutral, or alkaline. Solid tailings are impounded in tailings ponds and liquid effluents overflow to streams or seep into the ground. Uranium concentration in liquid effluents is usually well below the levels set forth in the regulations, otherwise improved metallurgy in the mill will prove economically worthwhile.

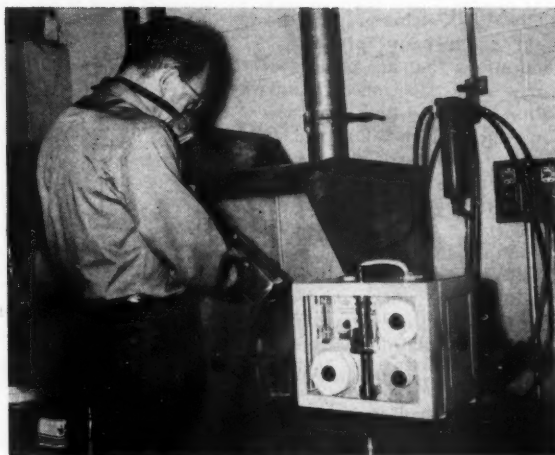
The majority of radium in the ore is insoluble and remains in the tailings solids; a small portion, possibly only one percent, may be dissolved. In acid-leach processes, the radium in solution does not follow the uranium chemistry but remains in the solution discharged to waste. In mills using the alkaline leach-caustic precipitation process, the radium in solution after leaching of the ore will be precipitated with the uranium. Perhaps 50 percent of the thorium-230 in the ore may be dissolved and this, like the radium, leaves in the effluents.

Radium has been the material of most concern to the mills regarding effluent decontamination and release to the environment. Only about one-third of the uranium mills discharge liquid wastes to streams and most of these conduct a monitoring program in which effluents are measured and sampled, and the stream above and below the mill is also sampled. Radium, thorium, and uranium determinations are then made on composite samples. As an example, Union Carbide Nuclear Co. maintains some 35 stations where effluent or river waters are sampled daily or weekly. Composites are assayed for radium-226, thorium-230, and uranium determinations are made. River dilution factors are calculated for average and low water flow periods. This provides a continuous monitoring program in order that effects, if any, on the rivers can be evaluated.

Effluents Decontaminated with Barium Salts

With few exceptions, dilution by the streams is sufficient that any in-

A continuous-tape air sampler is used to determine airborne uranium concentration in a sample-bucking room. After possibly several days of continuous sampling, the tape will be cut and assayed fluorimetrically for U_3O_8 content



crease in the Ra-226 content of the stream is considerably below the natural background concentration of Ra-226. The regulations specify that, unless special approval is given, effluents released to unrestricted areas shall not exceed a Ra-226 concentration of 1×10^{-8} $\mu\text{C}/\text{ml}$. The natural radium content of many of the rivers in the location of the mills is 1.0×10^{-9} $\mu\text{C}/\text{ml}$. With large dilution factors, it is usually impossible to detect any increased radium effect on the rivers. Also, analytical methods for determining radium concentrations at such low levels are exacting and time-consuming. The presence of numerous other isotopes of radium and thorium further complicate the procedures.

Some mills located on smaller streams where dilution factors are not high decontaminate effluents by radium removal using barium salts such as barium sulfate and barium chloride. Other mills where liquid effluents percolate into the ground use monitoring wells around tailings ponds for obtaining samples with which to study any effect on the ground water.

Although the volumes of liquid and solid wastes from uranium mills are large, the quantity of radioactivity is small compared to other atomic energy installations.

Release of Stack Effluents to Unrestricted Areas

To evaluate the effect of mill stack effluents and wind-borne material, it is necessary to take air samples at various locations around mill areas. This is particularly important where mills are located near towns or living quarters. Extremely low limits have been established for uranium concentrations in airborne effluents released to unrestricted areas (for ore dust,

3×10^{-13} $\mu\text{C}/\text{ml}$).

Although stack samples may be taken to determine uranium concentrations, in most cases it is not practical to attempt to meet the concentration limits in stacks on dust collectors, roasters, concentrate dryers, and scrubbers, even though dust collector efficiencies may be very high. A more practical approach is to sample at various locations from the restricted area boundaries on out and away from the mill, with emphasis on down-wind directions. These samples generally show levels well below the limits, indicating the levels of release from the restricted area are below the regulation levels.

Records Required by AEC Regulations

Complete and permanent records need to be kept of all data connected with the radiation control program. This includes sampling data, analytical results, methods used for making time studies and their results, exposure calculations, film badge results, external radiation readings, and detailed information on waste disposal procedures. This information is required by the AEC regulations and is also important to retain for possible future purposes in connection with individual exposure records.

Records must be kept in the same units, i.e., microcuries per milliliter, mr, rems, etc., as are shown in the regulations. The reason for the latter is obvious and is an excellent step toward standardization in the industry.

Conclusions

Over the past ten years, the domestic uranium mining and milling industry has seen an expansion from the production of 320 tons of uranium concentrate in 1950 to 17,700

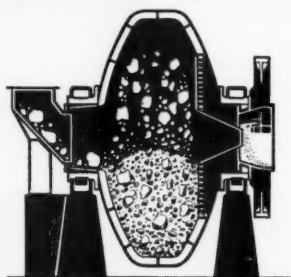
tons in 1960. This rapid growth brought about many problems and considerations that are characteristic of a new industry. One of them was radiation control which was new to the mining and metallurgical field. The potential hazards were studied, corrective action taken where necessary, and the evidence to date shows a good record of health experience, equivalent to most any other industry. Probably in no other industry has the health of the worker and the industry's effect on the environment and the general population been studied more thoroughly or received more attention.

Radiation control is today an integral part of the atomic energy industry and as the use of the atom increases, in the form of isotopes for instrumentation and tracers and in reactors for power and process heat production, radiation control will become more and more an essential part of all industrial health and safety programs.

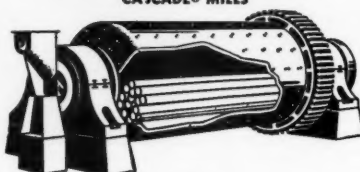
REFERENCES

1. Friedlander, G. and Kennedy, J. W. *Nuclear and Radiochemistry*, John Wiley & Sons, New York, Nov. 1957.
2. Kinsman, S., et al. *Radiological Health Handbook*, U.S. Dept. of Health, Education and Welfare, PB 121784, Cincinnati, Ohio, Jan. 1957.
3. Glasstone, S. *Sourcebook on Atomic Energy*, Second Edition, D. Van Nostrand Co., Princeton, N. J., 1958.
4. *Protection Against Radiations from Radium, Cobalt-60, and Cesium-137*, National Bureau of Standards Handbook 54, Washington, D. C., Sept. 1, 1954 (price \$0.25).
5. Brannigan, F. L. *Living With Radiation*, 1. Fundamentals, U.S. Atomic Energy Commission, Washington, D. C., 1954 (price \$0.45).
6. *Recommendations of the International Commission on Radiological Protection*, Pergamon Press, New York, May 10, 1960.
7. "Report on ICRP Committee II on Permissible Dose for Internal Radiation (1959), With Bibliography for Biological, Mathematical and Physical Data," *Health Physics*, Pergamon Press, New York-Oxford, Vol. 3, June 1960.
8. *Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water*, Bureau of Standards Handbook 52, Washington, D. C., March 20, 1953.
9. *Permissible Dose from External Sources of Ionizing Radiation*, Bureau of Standards Handbook 59, Washington, D. C., Sept. 24, 1954.
10. *Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure*, Bureau of Standards Handbook 69, Washington, D. C., June 5, 1959.
11. Holaday, D. A., et al. *Control of Radon and Daughters in Uranium Mines and Calculations on Biologic Effects*, U.S. Dept. of Health, Education and Welfare, PHSP 494, Washington, D. C., 1957.

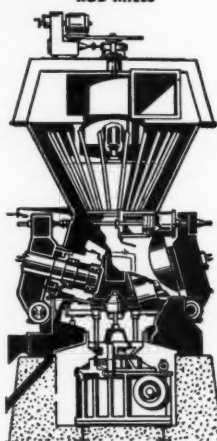
GRINDING AND PULVERIZING



CASCADE® MILLS



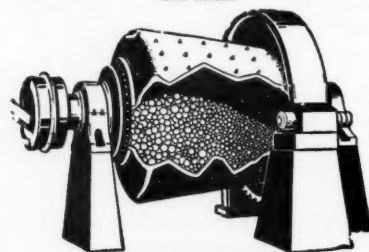
ROD MILLS



DISC-ROLL MILLS



TUBE MILLS



CONICAL AND TRICONE MILLS

No matter what your grinding problem—coarse or fine grind—ball, pebble or autogenous — Hardinge has a mill for the job.

CASCADE® MILLS

A continuous mill using the autogenous grinding principle—large pieces of material grinding the smaller ones. Shape of the mill causes maximum "free fall" and impact. Feed is divided into coarse and fine components and re-combined in proper proportion for best grinding.

ROD MILLS

Steel rods are employed as grinding media. Ideal for producing minimum oversize in open circuit grinding. Conical heads prevent "choking" of the charge at the ends, and align the rods. Available with either end, or center, peripheral discharge, as well as trunnion overflow.

DISC-ROLL MILLS

A roller-mill with rotating grinding table and spring-loaded rolls. The "Gyrotor" Classifier, combined with the Disc-Roll Mill, provides a highly-efficient dry-grinding device, ideal for relatively soft minerals.

TUBE MILLS

For a fine product in open circuit without the use of classifiers. For mixing and grinding to secure a smooth texture or plastic product. Often used as an autogenous grinding mill.

CONICAL MILLS®

The shape of the Hardinge Conical Mill causes a rapid circulating and classifying action within the drum, which increases the capacity for power expended over other types. The range of grinding is large, due to segregation of media and material within the mill.

TRICONE MILLS

Built on the same principle as the Conical Mill, the Tricone Mill offers greater grinding volume for a given amount of floor space than any other tumbling mill built. Extremely efficient. Ideal for large tonnages. Sizes up to 12 ft. diameter.

Consult your nearest Hardinge office, giving them full details of your grinding problem.

HARDINGE
COMPANY, INCORPORATED

Main Office and Works • 240 Arch St., York, Pa.

"Hardinge Equipment—Built Better to Last Longer."

NEW YORK
TORONTO
CHICAGO
HIBBING
SALT LAKE CITY
SAN FRANCISCO
HOUSTON
LAKELAND
BIRMINGHAM



Just **RIP** **TIP** and **POUR**

You don't have to mix these
new economy blasting agents

DU PONT NILITE[®] 101 AND 202

The minute you tear the corner off your first 50-lb. bag of "Nilite" 101 or higher-density "Nilite" 202, you'll enter a new era in blasting.

Now at last you have two low-priced, free-running blasting agents that give you Du Pont quality performance, shot after shot.

You don't mix "Nilite" on the job. You don't mix it at all. Just rip open the bag and pour it into any hole—small, medium, large—from 2" diameter up. No clogging, no bridging in the hole.

No clouds of dust, and no ingredient to cause headaches. No messy oil-stained bags.

But easy loading is only part of the story of "Nilite." For full data on rock-breaking power, better propagation, greater safety and other advantages, send for our new fact sheet on "Nilite" or call your Du Pont distributor or representative. Start saving on your blasting . . . soon. Du Pont, Explosives Department, 6440 Nemours Building, Wilmington 98, Del.

*Flows freely
even in
holes as
small as . . .*



BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

NILITE[®]

Maintenance Costs Reduced by Redesign of Fine Coal Cleaning Plant

By DAVID G. WERNER

Maintenance Engineer
Pittsburgh Coal Co.
Division of Consolidation Coal Co.

MAINTENANCE of a preparation plant is a two-dimensional problem—the plant must operate efficiently with a minimum number of delays, and more important, within a reasonable cost.

To work within a reasonable cost at one of Pittsburgh Coal Company's plants was literally impossible because there was just "too much plant" to process the 240 tph of $\frac{3}{8}$ -in. by 0 raw coal. Therefore, the only solution for cost reduction was to redesign the existing plant with an emphasis on simplicity and economy.

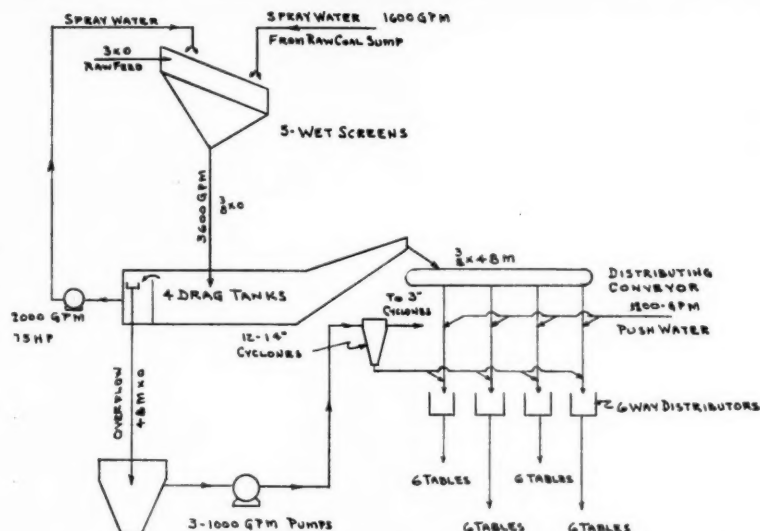


Fig. 1. Flow sheet of original plant shows that the basic function of the drags, cyclones and distribution conveyor is to dewater the $\frac{3}{8}$ -in. by 0 coal from the wet screens so that water can again be added to the coal in the proper amount for the Deister table feed

To understand how this was done let us first examine the flow sheet (figure 1) of the original plant. The $\frac{3}{8}$ -in. by 0 raw coal from the vibrating screens is flumed to the drag tanks where it is classified into $\frac{3}{8}$ -in. by 48 mesh and 48 mesh by 0. The $\frac{3}{8}$ -in. by 48 mesh traces from the drag tanks to distribution conveyor, and enroute to the six-way distributors, water is added in the proper amount for the Deister table feed. Simultaneously, the 48 mesh by 0 overflows the drag tank and traces thru the pumps, cyclones and then to the distributors. The basic function of the

drags, cyclones, and distribution conveyor is to dewater the $\frac{3}{8}$ -in. by 0 coal from the wet screens so water can again be added to the coal in the proper amount for the Deister table feed.

Figure 2 shows the alteration with the "drag-tank" circuit cut out. The $\frac{3}{8}$ -in. by 0 coal from the vibrating screens flows directly, by a common flat-bottomed flume, to the distributors. The proper amount of excess water is removed by the $\frac{1}{2}$ -mm screen in the bottom of the flume. The effluent from the $\frac{1}{2}$ -mm screen traces thru the pumps and cyclones to the distributors. The push water is now available to replace the water from the 2000-gpm spray water pump, which can be discontinued. Of all the machinery involved in the conversion, nothing had to be moved or conflicted with the flume installation.

Table I shows the machinery now in use.

Table I. Machinery deleted from new plant

	Connected Horsepower
4—Drag tanks	80
1—Distribution conveyor	25
1—Cyclone pump—100 gpm	60
4—14-in. cyclones	
1—Spray pump—2000 gpm	75
Miscellaneous piping, flumes, valves, electric circuit breakers, and controls.	

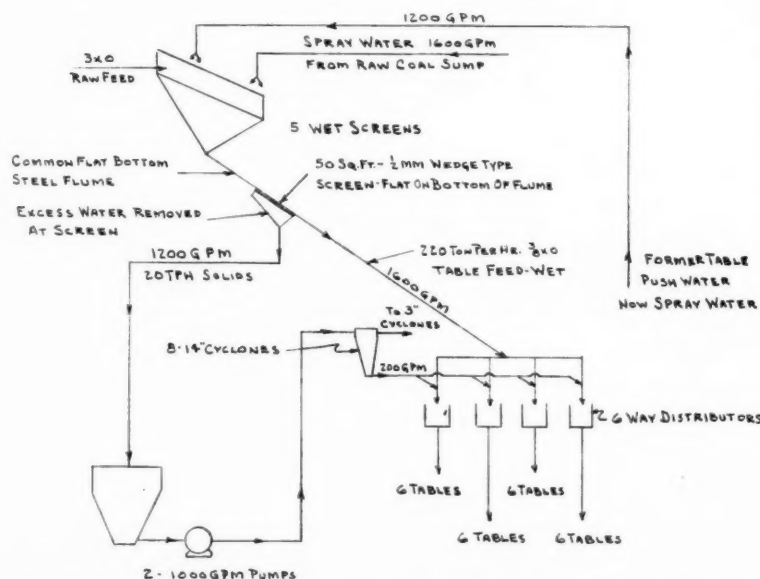


Fig. 2. The new plant, which has the "drag-tank" circuit cut out, is practically maintenance free

The "flume plant" is operating satisfactorily, and has been a big step forward to a better maintenance and operating cost. As compared to its older counterpart, the new plant is practically maintenance free, requires less horsepower, and is almost foolproof against breakdowns.

The maximum benefits of using increasingly larger haulers will be realized only if great care is taken in tire selection

By G. E. DANBY

Manager
Sales Development Department
Euclid Division
General Motors Corp.

Economics of Large Tires for Earthmoving Equipment

WHILE many factors affect haulage costs, one of the most crucial is tire life. This is becoming increasingly important as more open pit operators utilize larger capacity haulage units. The following tabulation, which shows the replacement cost of tires expressed as a percent of list price of Euclid haulers, emphasizes this important point:

Hauler	Tire Replacement Cost, Percent of Hauler List Price
10 ton rear dump	7
15 ton rear dump	7
18 ton rear dump	12
22 ton rear dump	11
27 ton rear dump	11
40 ton rear dump	14
55 ton rear dump	13
18 yd scraper	18
24 yd scraper (twin power)	18
33 yd scraper	20

Tire replacement cost increases at a faster rate than the increased in-

vestment required for larger vehicles. For example, in the Euclid rear dump line, the percentage of tire replacement costs in relation to capital investment in the vehicle increases from approximately seven percent on the smaller units to approximately 14 percent on the larger units. In these cases, we are dealing in tire sizes ranging from 11.00x25 to 18.00x33.

In the case of the large self-propelled scrapers, often used to strip overburden, the percentage of investment in tires is of the order of 18 percent to 20 percent. Here we are talking about tires ranging in size from 27.00x33 to 37.5x33. Another comparison which illustrates the same point is shown in figures 1 and 2.

Ways to Promote Tire Life

While most operators are aware of many of the basic requirements that tend to promote long tire life, in light of the foregoing, it would be well to

review some of them briefly.

Building and maintaining good haul roads have become a well accepted practice that results in important economies in the mining industry. It not only increases tire life, but also permits vehicles to travel at high speeds and thus increases production.

Hazards of snagging and cutting tires in the loading and dumping areas makes the use of bulldozers or similar equipment mandatory on many operations as a clean-up tool. This is particularly true in mines where sharp abrasive ores or overburden are being handled.

Selection of the right tire for the job is most important, but at this point, it will suffice to say that selection of the best tread design for adequate traction and tread life for a given application is usually determined as a result of previous job experience.

Figure 1 shows the various sizes

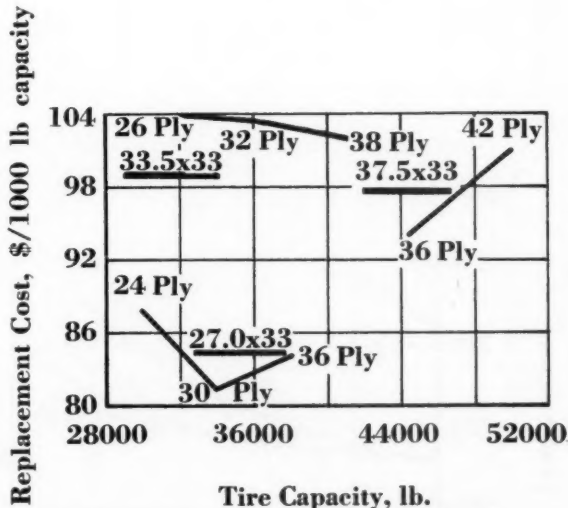
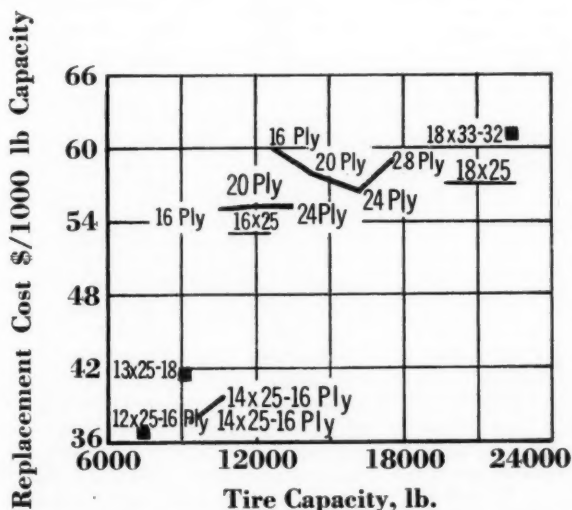


Fig. 1. (Left) Tire replacement costs per 1000 lb load carrying capacity on Euclid rear dump haulers follow no regular pattern within the various ply ratings for a given tire but do increase with increasing tire size. Fig. 2 (Right) Tire replacement costs on the larger Euclid scrapers. Note that the 37.5 x 33 tire is somewhat less expensive than the smaller 33.5 x 33

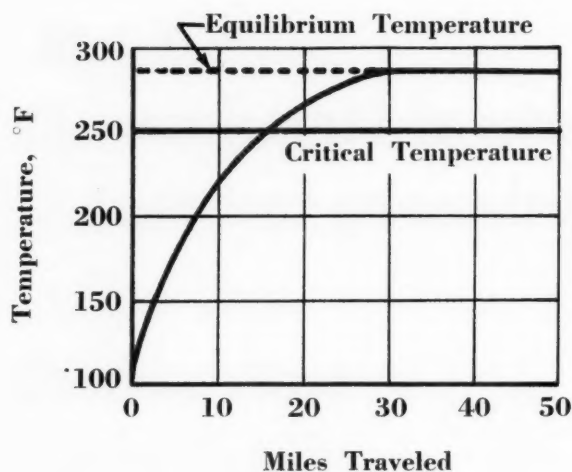


Fig. 3. Internal carcass temperature of the tire increases rather rapidly during the first few miles of travel and then levels off at an equilibrium temperature when heat generated by tire flexing is balanced by the heat radiating from the tire

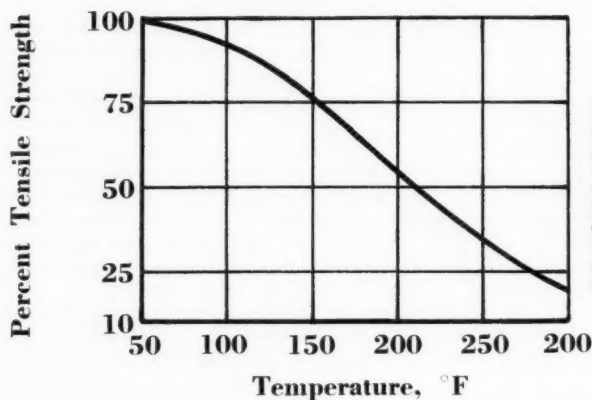


Fig. 4. Reversible effect of temperature on tensile strength. If the equilibrium temperature is above the critical point of approximately 250° F, the rubber breaks down and heat failure eventually occurs

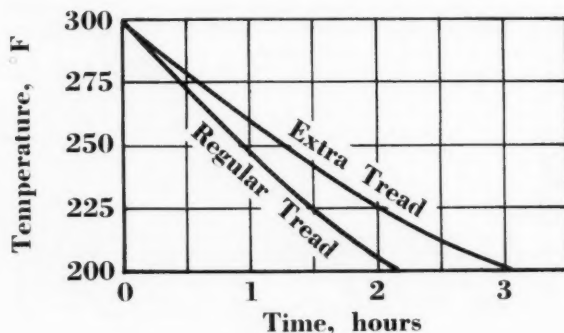


Fig. 5. The rate of cooling for a tire with a regular tread is about 1° F per minute and for a tire with an extra heavy tread is about 1/2° F per minute

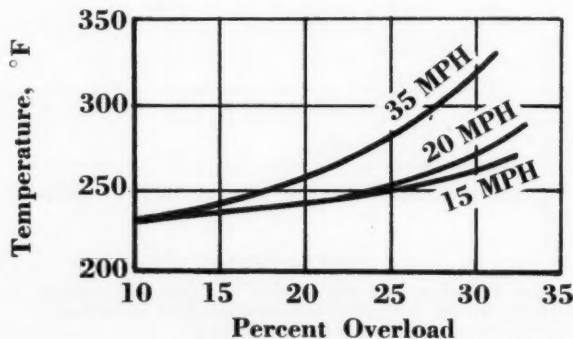


Fig. 6. Effect of speed and overload on tire temperature. The critical temperature of 250° is reached at relatively moderate speeds and overloads

of tires used on Euclid rear dumps. The replacement cost per 1000 lb of load carrying capacity follows no regular pattern within the various ply ratings for a given tire, but it does increase appreciably with increasing tire size. Figure 2 shows the same relationship for tires used on the larger Euclid scrapers. The only exception is the 37.5x33 tire which is somewhat less expensive per 1000 lb of capacity than the next smaller tire which is 33.5x33.

The foregoing comparisons are particularly important when we consider that it is generally accepted practice in our industry to consider tires as expendable and not subject to depreciation. In other words, their replacement costs are considered as part of operating expense as are tire repairs, maintenance and recapping. Unquestionably, tires are one of the largest single factors in the operating expense of the larger haulage units.

Regular, thorough inspection and maintenance of tires cannot be over-emphasized if long tire life is to be achieved. All the major tire companies offer expert guidance in this respect and will assist in setting up preventive maintenance programs.

Premature Failure from Excessive Heating

The most prevalent tire problem in modern haulage pits, namely, premature failure due to excessive heat deserves closer attention than the previous subjects.

Figure 3 illustrates heat build-up within an off-highway tire. The internal carcass temperature of the tire increases rather rapidly during the first few miles of travel and then levels off at an equilibrium temperature when the heat generated by tire flexing is balanced by the heat radiating from the tire. If the equilibrium temperature falls below the critical temperature at which the tire is cured, heat failure will not be a problem. However, if, as so often occurs and as shown on the graph (figure 3), the equilibrium temperature is above the critical temperature of approximately 250° F, the rubber breaks down and heat failure eventually occurs (see figure 4).

Increasing tire temperature decreases the tensile strength of the tire at a relatively fast rate. Over-heating of tires is further compounded by the fact that rubber is a rather poor conductor of heat. While a hauling unit sits under a shovel or on a dump, the tires begin to cool, but the rate of cooling is relatively slow.

Tires with a regular tread cool at

the rate of approximately 1° F per minute, and tires with an extra heavy tread cool at the rate of approximately 1/2° F per minute. For example: if a tire heats up to the maximum permissible temperature during a certain part of a vehicle's hauling cycle, it will require approximately 20 minutes to bring the temperature down 20° if the vehicle is stationary and the ambient temperature is approximately 60° F. In the case of the extra tread tires, it will require approximately 40 minutes to bring the temperature down the same 20°.

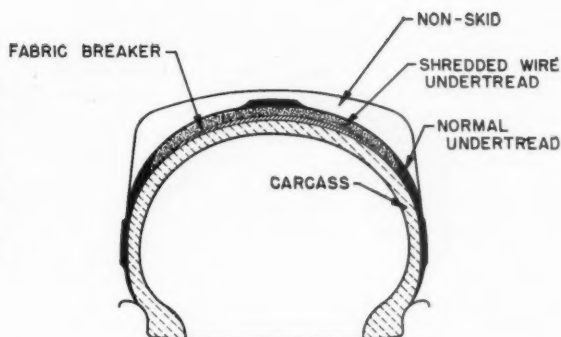
Overloading Can Increase Haulage Costs

The mining industry is no different from any commercial enterprise where competitive pressures force management to constantly strive for lower costs. A fairly common practice consists of overloading vehicles and tires well beyond their rated capacity. This, combined with a modern off-highway hauler's ability to travel in excess of 30 mph, is conducive to short tire life. Excessive overloads and speeds are apt to increase rather than reduce haulage costs.

Figure 6 shows the effect of both overloading and over-speeding on long hauls with conventional off-highway tires. The critical temperature of 250° is reached at relatively moderate speeds and overloads.

The question now arises: What is the tire industry doing to solve the heat problem and thus permit mine operators to economically utilize the maximum production potential of modern haulers? At the present time,

Fig. 7. Typical shredded wire construction for off-the-road tires. Indications are that this development will represent a major step forward in the tire industry's search for a solution to heat problems



there is no cure-all solution to this problem. Technical progress in the tire industry has been, and probably will continue to be, evolutionary, rather than revolutionary. There are, however, certain types of tires available or about to become available which are primarily designed to alleviate extreme heat problems. Basically, they can be classified in three categories: (1) Semi-highway tires, (2) heat and cut resistant tires, and (3) shredded wire tires.

Tires for Service Under Extreme Heat Conditions

Semi-highway tires are designed for the long haul, high speed application on good haul roads where overloads are not excessive. Streamlined construction of this off-highway tire reduces bulk without reduction of tire strength. The reduced bulk permits relatively fast dissipation of heat and promotes long tire life. The semi-highway tire, however, is prone to cutting and should not be used on jobs where these conditions exist. This

tire development is somewhat new having been given limited exposure in certain areas of the country during the last three or four years. Properly applied, it does extend tire life over conventional tires.

Generally speaking, heat resistant tires have the same bulk and tread rubber as conventional tires and would be best applied on those jobs where some overload and some high speed haulage will occur. Basically, this tire resists heat failure by use of heat resistant rubber compounds.

Tires having cut resistant properties are usually constructed with increased tread rubber, and are made from cut resistant rubber compounds. This type of tire will stand up well on rough haul roads with some overloads, but will not endure on high speed hauls because, unfortunately, rubber compounds with cut resistant properties do not stand up to extreme heat.

Tires with the extra tread rubber, but constructed from heat resistant compounds are compromise tires which fit many operations. In this

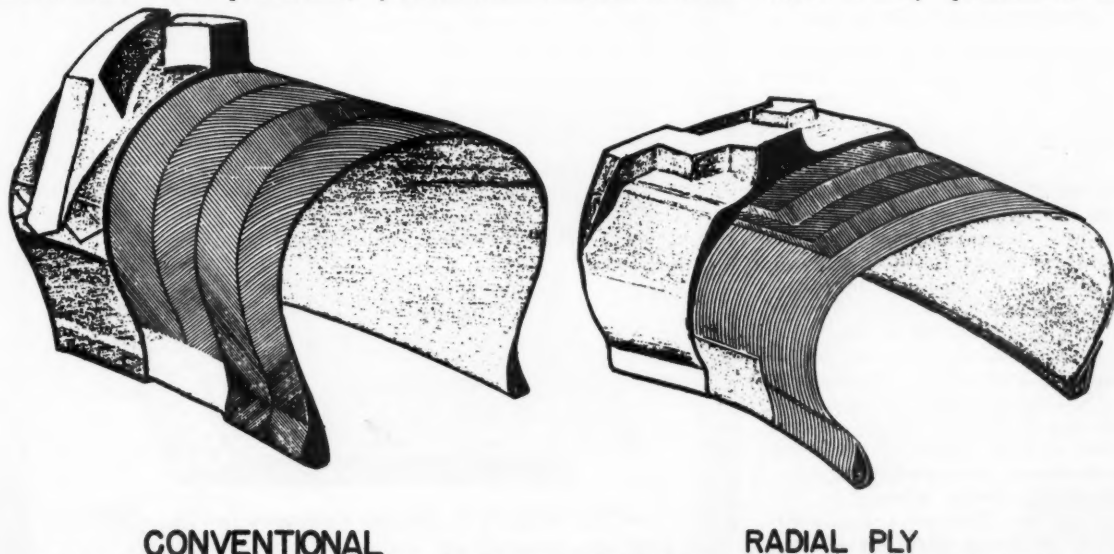


Fig. 8. The plies in conventional tires (left) are on the bias, while on radial ply tires (right) there is only a single ply of steel wire (or several nylon plies) whose strands are at right angles to the tire circumference

case, moderately high speeds and moderate overloads will yield acceptable tire life on average haul roads.

A recent development in the off-highway tire industry has been the testing of shredded wire in the under-tread rubber. These tests indicate that shredded wire construction results in increased tire life, particularly in wide based tires. The short strands of wire embedded in the under-tread offers resistance to small and medium size cuts and also prevents "cut growth" which results in ply, breaker, or tread separation.

The wire also supplies a physical bond between the tire tread and carcass. The roughness of the shredded wire binds these components together, decreasing the possibility of ply separation. These wire shreds also conduct heat away from tire hot spots which occur in those areas where there is excessive bulk. This type of tire is recappable. Indications are this shredded wire development will represent a major step forward in the tire industry's search for a solution to heat problems.

It is evident from the foregoing discussion that the trend to larger haulers using more expensive tires will tend to negate lower haulage costs, unless great care is taken in the selection of the type of tire construction and compounding which will yield acceptable tire life on given job conditions.

It is also evident that the tire industry is making a serious effort to supply the kind of tire construction and rubber compounding which will alleviate the heat problems which are so prevalent.

Development of Radial Ply Tire

Beyond the present requirement for a high degree of selectivity to obtain satisfactory tire life, what is the tire industry doing in the way of new developments?

There are several long range projects under study within the industry. One of these is the constant research which is going on using synthetic rubber to obtain the most desirable physical and chemical properties needed for tire construction. Another involves the testing of various fibres including steel wire for use in the construction of the tire carcasses.

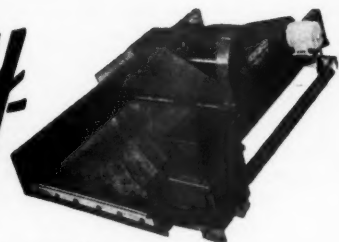
The latest breakthrough in tire design and development revolves around radial ply tires (figure 7). These new tires, already in limited on-highway service, are being adapted to off-highway use. They are radically different in design from the conventional tire in which plys are on the bias, that is, they are placed in the

carcass at an angle of approximately 70° to each other. In the radial ply tire, a single ply of steel wire (or several nylon plys) embedded in the carcass is aligned so that the strands are at right angles to the circumference of the tire. There are also steel cables embedded in the under-tread and aligned in the direction of rotation of the tire.

Preliminary reports indicate that while this tire may have some limitations at the present time, it is eventually expected to yield several advan-

tages such as increased tractive ability, less rolling resistance in some materials, improved ride characteristics, much longer tread life, and a substantial reduction of failures due to heat. Apparently, its only limitation is its lack of resistance to sidewall cutting. Indications are that some manufacturers will start producing radial ply off-highway tires in the near future. If it proves successful, it certainly will be a much needed technological advancement in the tire field.

THE Leahy
HEAVY DUTY



VIBRATING SCREEN

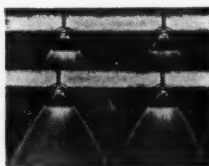
Efficient Screening of Any Fine Mesh Material

The Leahy® screen is capable of handling just about any screening problem in the fine mesh range . . . efficiently and economically.

Vibrating only the jacket, it cuts power costs substantially. Exclusive differential vibrations, 1600 per minute, snap oversize wedging particles loose, making it possible for the screen to work on long, back-breaking schedules continuously without time-consuming mesh-clearing headaches.

When damp or sticky materials are encountered, integrated FlexElex® jacket heating is available.

The screen is made in 12 sizes—open or dust proof models. Send for Bulletin 15-J.



CONCENCO® Spray Nozzles

These handy nozzles are simple, flexible and economical. All you do is drill oversize holes in spray line, one per nozzle, clamp on and get results. They can be definitely aligned for washing, sluicing or spraying according to need. They are removed or replaced in a moment's time.

THE DEISTER ★
CONCENTRATOR
COMPANY

723 Glasgow Ave. • Fort Wayne, Ind., U.S.A.

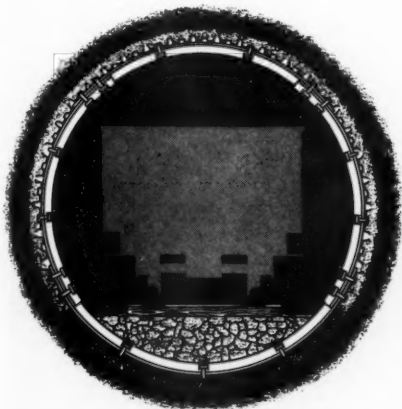
CONCENCO
PRODUCTS

★ The ORIGINAL Deister Company • Inc. 1906

**WHEN
PRESSURES
SQUEEZE
FROM ALL
DIRECTIONS**



...install Bethlehem Yieldable Rings



Lagging should completely surround the Yieldable Ring set. Poles, planks, steel ties make good lagging.



For strength
... economy
... versatility

If your mine opening has a heaving bottom, or is subject to squeezing pressures from all directions, the Bethlehem Yieldable Ring offers the best means of control. The Ring is a four-piece yieldable set with four joints instead of the usual two found on the Yieldable Arch.

Essentially, the Yieldable Ring is similar to the Yieldable Arch. It is made of the same nestable U-shaped sections, works on the same sliding-joint principle, and is available for the same range of mine openings—from 6 to 20 ft in diameter.

Installation of the Ring set differs from the Arch in that the two joints at the bottom of the ring should be tightened to about 150-ft-lb, instead of the 180-ft-lb torque normally applied. This is due to the fact that the bottom two joints usually will lie in muck, which adds measurably to the friction in the joint.

One more important point: with the Yieldable Ring, as with the Yieldable Arch, lagging and packing are necessary to fill the voids between steel and rock. Lagging should *completely surround* the Yieldable Ring, as shown in the sketch.

Bethlehem engineers will be glad to visit your workings to determine how the Yieldable Ring or Arch might improve your roof control. For action, just get in touch with the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



Operators' Corner

ROUTINE SAFETY CHECK*

Frequent and systematic checks of bolting procedure are the only way to assure adequate roof control

NOTHING contributes more to bolting safety than a well-developed bolting program which is faithfully followed, day-in and day-out, every time the bolting crew goes into action.

The checklist that follows outlines some of the more important points to consider.

Hole Size

Undesirable variations in hole size, may be caused by worn bits, by improper drilling, or by changes in roof

formation. Worn or oversize bits, loose jointed drill extensions, or drill "whip" can cause improperly sized holes, "dog-legged," or rifled holes. Oversize holes may result from bits of improper size or bits that are ground off-center or with one short cutting lip, or from a bit that's allowed to spin or "dwell" too long at the point of anchorage.

Although such variations in hole size can have an appreciable effect on the holding power of installed units, the minor faults that cause them sometimes go unnoticed until they become major ones that actually interfere with bolting.

Periodic checks of hole size with a hole gage like the one shown in an accompanying picture can reveal these faults before they become serious enough to cause trouble.

Bolt Installation

Expansion units should be turned on the bolt far enough to start the thread correctly, but not far enough

to waste thread required for proper tightening. The proper distance can be obtained from the supplier.

Ordinarily, the assembled unit should be pushed most of the way up the hole by hand, rather than by the wrenching machine. In this way the bolters not only get the feel of the bolt holes they're drilling (sometimes sensing one of the fault conditions mentioned earlier), but there's also no danger of bending the bolt or damaging the expansion unit if it should momentarily be hung up by some obstruction which the bolter could probably work around in a second or two.

Usually, it's much faster to shove the bolts up by hand, allowing the unit to hang there until the wrench is maneuvered up to the bolt head for final wrenching.

Wrenching

It's important to make sure that bolt head and roof plate are firmly against the roof before wrenching begins. Otherwise, the bolt will thread itself through the plug for a number of turns without becoming tensioned. When it finally begins to tension, there may not be enough threads left on the bolt to develop full tension or complete expansion of the anchor.

Under average conditions, 50 to 80 lb of tension are developed for each ft-lb of torque. If this factor is conservatively taken at 60, then a torque of about 150 ft-lb will result in an optimum bolt tension of 9000 lb—well below the elastic limit of a mild steel $\frac{3}{4}$ -in. bolt or a $\frac{5}{8}$ -in. high strength bolt. This, of course, assumes that the bolt head bears against a level roof plate and that no unnecessary additional friction is created by ex-



(Left) O-B Hole Gage is used to spot-check bolt holes to insure that hole diameter is held within recommended limits. Use of gage also aids detection of other hole faults described in this article. (Right) Hand torque wrench is used to check accuracy of the torque setting on the bolting machine. Occasional spot checks will also reveal any appreciable variations in bolt tension in previously bolted areas away from the face

cessive upward pressure of the wrench.

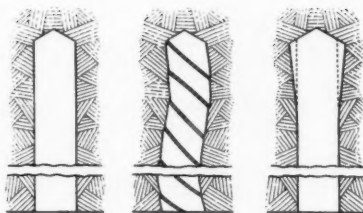
If the roof plate is not level, there may be danger of twisting off the bolt head at torques over 175 ft.-lb. In very soft top, where anchorage capacity is limited, bolts may be tightened with a hand torque wrench to determine suitable installation torque for the bolting machine.

Checking Torque of Installed Units

Various circumstances may tend to change bolt tension after a period of time. Spot checks with a torque wrench should be made occasionally to determine whether bolt tension has increased or decreased in areas behind the working faces.

An increase in tension will usually indicate that roof action has occurred. A decrease in tension may also be due to roof action or to plastic flow of the roof materials in which the expansion unit is anchored. Use of wood headers may also contribute to a gradual decrease in bolt tension, although the use of cured, treated wood headers and steel roof plates will help to reduce tension loss substantially.

Spot checking with a hand torque



Drawing at the left shows a proper bolt hole—straight with smooth walls. Rifling and dogleg shape are illustrated at the center. If the drill is allowed to "dwell"—that is, allowed to stay in one position while it is revolving, an oversize hole can be produced, as shown in the drawing at right

wrench will show whether tension drop-off in any area has proceeded far enough to warrant retightening. Newly installed units right at the face should also be checked at frequent intervals to make sure the torque setting of the wrenching machine is accurate.

Bolt Pull Tests

Perhaps the most comprehensive test of over-all bolting procedure is the bolt pull test. Here the bolt and the expansion unit are subjected to

abnormally high loading to determine the actual strength of the complete installation.

The bolt is pulled until something gives—either the bolt or the anchorage. Under ideal conditions, nothing will give until the bolt has stretched and finally broken.

When a series of pull tests show that this tension can be developed fairly consistently before failure occurs, then it's a pretty good indication that the bolt, the expansion unit, and the general installation procedures are actually doing the job they're supposed to do.

It should be mentioned, however, that in certain types of "soft" roof it may be impossible to break a roof bolt, regardless of the type of anchor used. This doesn't mean that the roof can't be successfully bolted, however, as long as a sufficient bolt tension can be maintained.

(Editor's note: The December 1959 issue of MINING CONGRESS JOURNAL carries a report by the AMC Coal Division Committee on Roof Action entitled "Standard Roof Bolt Anchorage Testing Procedure." Copies of the report are available from the American Mining Congress, Ring Bldg., Washington 6, D. C.)



Conical plunger at top of gage (left) presses balls against hole wall as inner rod is raised. Ferrule at bottom of gage serves as indicator for reading scale at end of rod

SILICON RECTIFIERS

(continued from page 76)

were lost on each occasion.

The Hewitt rectifier, while much simpler than the ignitron, is more complicated than the silicon unit.

Reliability of the silicon unit was a factor that could not be proved in advance. Mine service, with its highly fluctuating load and occasional short circuit, might possibly cause trouble that would never occur in the chemical industry. The manufacturers' proposal had more than three times the design capacity of the chemical units so that even with several diodes out of the circuit, it seemed impossible to have an overload or short circuits to cause diode failure. A modern silicon rectifier has 14 diodes in parallel, each carrying 30 percent of their rated capacity at full load. With this designed-in safety factor, the mine can operate with two or three diodes out of each leg of the unit, then replace bad diodes at some convenient time. Diode failures have been rare, so the possibility of overloading operating diodes due to diode failure is extremely remote if any

kind of an inspection schedule is followed.

Regulated Versus Nonregulated Systems

Hanna's decision to use an unregulated system was based on experience in operating the unregulated Hewitt rectifier in parallel with the regulated ignitron rectifier. The two rectifiers were just over a mile apart and had equal breaker settings. Every time the 50-ton motor operated in the area of the ignitron, breaker outages were frequent, while the breaker on the Hewitt rarely opened when the 50-ton motor was close to it. The voltage regulator was cut out on the ignitron rectifier and breaker outages have become rare.

Regulation on a silicon rectifier is expensive—15 percent above the unregulated rectifier—so the matter of regulated against unregulated rectifiers should be carefully studied for each operation.

The higher efficiency of the silicon rectifier was not a factor in influencing the company's decision; however, the savings based on 50 percent load

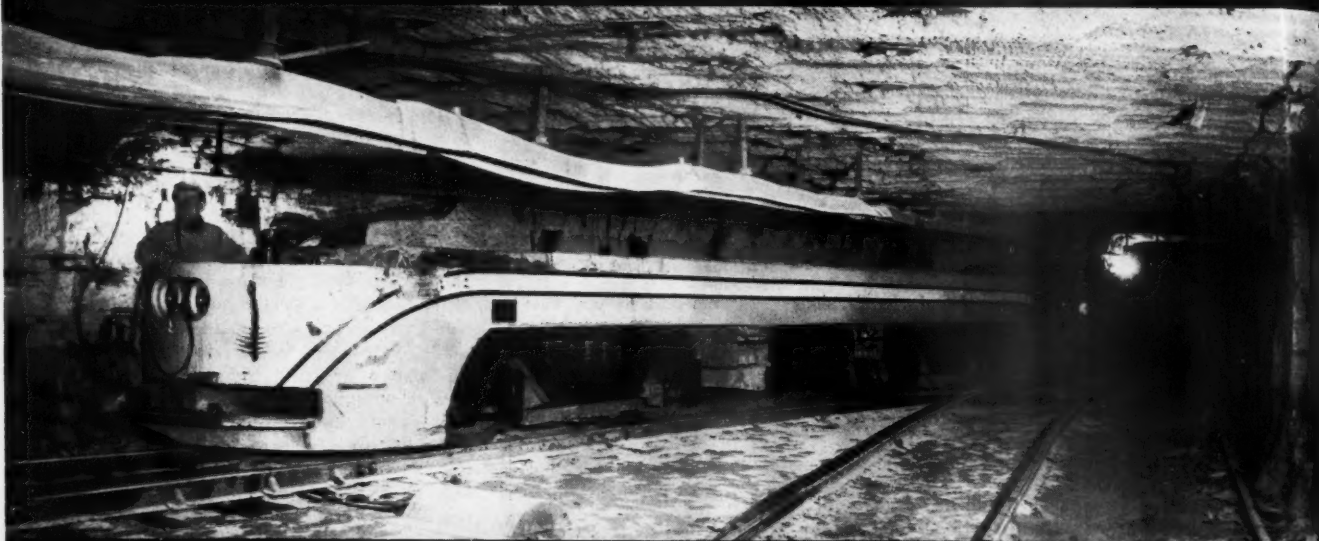
for 3000 hours per year amounts to \$550 a year.

Excellent Performance

Today the mine has two 500-kw silicon rectifiers in service. The first unit has been in service 15 months and the second 2½ months. Their performance has been excellent. They have never been off the line except to replace diodes. The original set had some faulty diodes in it which failed in the first six months of operation. This was alarming until the cause of the failure of diodes was determined. The manufacturing process of hermetically sealing the diodes was putting a mechanical strain on the junction. As soon as this process was changed, the mine ceased to have trouble and has had no failures in the last six months with the original unit. The newer unit has been in service continuously with no trouble of any kind.

Ireland's experience with silicon rectifiers indicates that they are the most economical, most reliable, and simplest conversion unit on the market today.

GENERAL ELECTRIC'S MINE LOCOMOTIVES



COMBINE ADDITIONAL SPEED AND POWER



TO INCREASE OUTPUT AND REDUCE COSTS

Below ground and above, General Electric 4-axle, swivel-truck mine locomotives build profits by hauling heavy loads at increased speeds.

The combined improvements in power, weight and speed reduce traffic congestion, simplify dispatching and boost tonnage per shift, thus reducing operating costs. Resulting performance matches the pace set by new highly productive face equipment.

Maintenance costs are lowered through latest design advances including high-rated motors, reliable control, rugged mechanical equipment and

easy accessibility to all components. Even track maintenance is reduced by the smooth-riding short wheel base swivel trucks.

For more information on how to increase output and reduce costs with modern motive power, call the nearest General Electric Sales Office or write General Electric Company, Erie, Pennsylvania.

116-01

Progress Is Our Most Important Product

GENERAL  ELECTRIC



wheels of government

As Viewed by **HENRY I. DWORSHAK** of the American Mining Congress

BACK in harness following its annual mid-session Easter recess, Congress faces the major portion of the year's work. Neither House has acted on the following items of President Kennedy's legislative program: Improvements in Social Security benefits, broad Federal aid to education, health care for the aged under the Social Security System, expansion of the community facilities program, and the easing of restrictions on trade with Iron Curtain countries.

All of these are controversial at least to some degree, and several bitter battles in both Houses are in prospect before the first session of the 87th Congress adjourns.

NATIONAL FUELS STUDY ENDORSED BY UDALL

Secretary of the Interior Stewart L. Udall, in a speech at the annual dinner of the National Coal Policy Conference in Washington, expressed full support of a comprehensive national fuels study such as that called for by pending Congressional resolutions.

"Our energy capacity is the index of our national strength and growth potential," he declared. "It is the true statement of how big a punch we pack, of our vitality and maneuverability, of our ability to sustain a rate of growth that will protect our national strength in the years ahead."

The Nation must plan its energy production and use requirements, he said, if the needs of our growing population and our expanding industrial economy are to be met.

Udall also referred to the work of the Office of Coal Research. "We want to broaden the scale of the research now under way and we want research that will encompass the entire industry—utilization, transportation and the technology of mining itself," he stated. "I can promise you that we will move energetically to implement the projects approved."

GEORGE A. LAMB HEADS OFFICE OF COAL RESEARCH

Appointment of George A. Lamb

★ ★ ★ ★ ★

Washington Highlights

CONGRESS: Faces heavy workload

FUELS STUDY: Endorsed by Secretary of Interior

COAL RESEARCH: Lamb heads new program

WATER POLLUTION: Mining views presented to Congress

WILDERNESS BILL: Still in Committee

TAXES: Congress will get Kennedy proposals

IMPORTS-EXPORTS: Impact on industry, labor to be studied

LEAD: International group plans supply curtailment

DEPRESSED AREAS: Aid bill passes Senate, House

MINERAL EXPLORATION: Federal loan program expanded

★ ★ ★ ★ ★

as director of Coal Research had been announced by Interior Secretary Udall nine days later. This office, established last year under authority of an Act of Congress, will contract with public and private agencies for coal research to supplement the work of the U. S. Bureau of Mines.

Since 1946 Lamb has been manager of business surveys for Consolidation Coal Co. He has been a member of various coal industry committees and served as consultant to the Cabinet Committee on Energy Supplies and Resources Policy in 1954.

MINING'S VIEWS PRESENTED ON WATER POLLUTION BILL

Following several days of public hearings, the House Public Works Committee is putting the final touches on the Administration-backed Blatnik bill to greatly broaden the Federal Government's authority in water pol-

lution control. The measure is expected to reach the House floor soon.

Under the present Federal Water Pollution Control Act, local, State and interstate agencies retain primary responsibility in pollution abatement matters; the Federal Government's power extends only to cases where the pollution affects more than one State. The Blatnik bill would give the Government authority to deal with all "navigable" and coastal waters even if the pollution involved affects only the State in which it occurs. The measure would also empower the Secretary of Health, Education and Welfare to issue pollution abatement orders which would be enforceable by Federal courts.

Walter F. Schulten, vice president, Consolidation Coal Co., Pittsburgh, testified at the hearings for the American Mining Congress and the National Coal Association. He declared that extension of Federal authority to all navigable waters would result in complete Federal domination in water pollution problems, reducing to little or no importance the work of State agencies and interstate commissions—such as the highly successful Ohio River Valley Water Sanitation Commission. This situation, he cautioned the Committee, would encourage development of a single national standard of water pollution control which might not reflect the needs and requirements of local conditions.

With respect to empowering the Secretary of H-E-W to issue abatement orders, the mining spokesman noted that the Secretary's orders would be based on hearings conducted by his agency and on his subsequent conclusions and findings. Enactment of this procedure, he said, would write into law the totalitarian principle of the Government acting as "judge, jury and policeman."

WILDERNESS BILL NOT YET SLATED FOR CONSIDERATION

Although the Senate Interior Committee completed hearings in Febru-

ary on the Wilderness bill, no date has yet been set for Committee consideration of the controversial measure. Chairman Anderson (Dem., N.M.), coauthor of the proposed legislation, is on record as favoring early action, and it may be scheduled at any time.

The bill would set aside some 15 million acres of wilderness, wild and primitive areas in the national forests for the exclusive use of wilderness enthusiasts. At present, these areas are open to mineral exploration and development under the mining laws; under the Wilderness proposal, exploration in these areas would be barred and their mineral deposits would be lost forever.

Mining spokesmen strongly pointed out that this feature of the bill is unwise, since the hard-to-reach lands in the wilderness areas have been subjected to little or no prospecting and represent the major remaining unexplored area of the public domain where important mineral deposits are likely to be found. Application of the mining laws to these areas should be continued, particularly since our rapidly increasing population and expanding economy require the maximum development and use of our mineral resources.

KENNEDY TAX PROPOSALS WILL GO TO CONGRESS SOON

On April 7, the White House announced the second postponement of the President's much awaited tax message. Originally scheduled for the end of March, the message will not be sent to Congress before the week of April 17.

Although there has been no official announcement of what the President will propose, it is reliably understood that the message will recommend (1) either a more liberal depreciation deduction, or a credit against the final tax for new investment in plant and equipment; (2) withholding of tax on dividends and some interest income; (3) a tightening of the deductibility of entertainment expenses; (4) repeal of the 4 percent dividend received credit presently allowed to individuals and (5) a plan to restrict the means whereby corporations organized in foreign countries are enabled to escape the U. S. income tax on their profits.

Apparently the new investment plan most favored by Treasury officials is one that would give a credit against the final tax, based on a percentage of the amount by which a taxpayer's new investment in plant and equipment in any year exceeds the depre-

ciation deduction for that year. Although specific details of this plan have not been made public, the principle has already been subject to violent attack. Opponents contend that such a plan will not accomplish the desired expansion and replacement of the Nation's industrial machine. Senator Smathers (Dem., Fla.), one of the critics, has urged the Administration to support his proposal, which would allow a taxpayer to select any period in excess of five years over which to depreciate new machinery.

Any proposal to give an incentive deduction on new plant and equipment will probably be accompanied by a provision restricting the right to apply the capital gains rate to sales of depreciable property.

It is expected that the House Ways and Means Committee will hold public hearings soon after the President sends his tax message to the Congress. These hearings will give interested taxpayers and their associations opportunity to express their views concerning the various provisions.

The details of the President's tax proposals will probably reflect the views of Stanley S. Surrey, who has been nominated by the President as an Assistant Secretary of the Treasury to handle tax matters. Surrey, whose confirmation hearing was held on March 22 by the Senate Finance Committee, has not yet been approved by that Committee. Some of the views which he had expressed while he was a professor at law at Harvard University met with the disapproval of various members of the Senate Finance Committee, although it is expected that ultimately Mr. Surrey will be approved and confirmed.

HOUSE LABOR GROUP PLANS IMPORT-EXPORT STUDY

A special subcommittee of the House Labor Committee has been set up to make a thorough study of the impact of imports and exports on American industry and labor. As part of the study, it will hold hearings in Washington and in various centers of unemployment.

Chairman of the subcommittee is Rep. Dent (Dem., Pa.). Other members are Reps. Bailey (Dem., W. Va.), Daniels (Dem., N. J.), Giaimo (Dem., Conn.), Kearns (Rep., Pa.), Bruce (Rep., Ind.) and Ashbrook (Rep., Ohio).

Dent said the study will be primarily concerned with these industries: Coal, textile, lead-zinc, glass, aluminum, chemical, fish, machinery, lumber, steel, electronic products and automobiles. Almost all of these indus-

tries have urged the Government to take action to curtail imports of the products which they produce, he said.

The Trade Agreements Act, which will be up for renewal next year, is expected to be the target of much of the testimony submitted at the hearings. The subcommittee's report is slated to be available by the time Congress begins consideration of the Act's extension.

INTERNATIONAL GROUP AGREES TO CUT LEAD PRODUCTION

Continuing its efforts to bring about a reasonable balance between world supply and demand for lead, the International Lead and Zinc Study Group has agreed that supplies of the metal should be curtailed to a level approximately 2 percent below estimated 1961 world consumption of nearly 2.5 million tons.

Announcing this decision at a Mexico City meeting last month, the Study Group said the cut was deemed necessary "in view of the existence of substantial stocks of unsold metal in producers' hands and the estimated surplus of about 90,000 tons over the record consumption in 1960."

The United States participates in the work of the 25-nation organization. In connection with the curtailment, the U. S. announced its readiness, until May 15, to barter surplus agricultural commodities for surplus lead stocks now overhanging the market.

No action was taken to reduce zinc supplies, the Study Group said, because producers' stocks were considered excessive only in the United States. It reported that world consumption of zinc in 1960 was at a record level—about 3 percent above 1959—and a rise of about 4 percent is expected for 1961.

U. S. zinc stocks are at a high level because of excessive imports. Despite this, delegates to the meeting were reminded, this country's import quotas remain open to the exporting nations and act as an escape valve for them.

The Study Group also announced that it would establish a special working group of 11 governments to examine methods, including intergovernmental commodity agreements, of coping with possible future problems of oversupply.

DEPRESSED AREAS BILL PASSES SENATE, HOUSE

The Senate and House have both passed a bill which would authorize Federal loans and grants totaling \$394 million for the redevelopment of

(Continued on page 163)

See this movie!
See the new S-D Automatic Overlapping Car
at our booth 1812
CLEVELAND COAL SHOW



Documentary movie shows how non-stop haulage achieved with fewer men and less equipment.....

A year was necessary to film, at intervals, the operations you will see in this actual case history of a change-over to S-D Automatic Overlapping Cars. It shows operations BEFORE . . . DURING . . . and AFTER conversion to a main line haulage system that reduced cost to the minimum and provided Non-Stop Maximum Haulage — with fewer men and less equipment. It further features Automatic Loading Stations, what they do and how they operate in this mine. This documentary 22-minute color

and sound 16mm movie is available now for your review. Ask us to mail this film to you for showing to your operating personnel . . . or, ask us to have one of our representatives bring projector and the movie to show for you. Write or call us today. Use coupon below to make mail request.

SANFORD-DAY
KNOXVILLE, TENNESSEE

SANFORD-DAY P. O. Box 1511 KNOXVILLE, TENNESSEE

☐

We have sound projector. Please mail film "Non-Stop Maximum Haulage" to us for review and study.

☐

Please have your representative contact me. We would like to have him visit us to show the movie "Non-Stop Maximum Haulage".



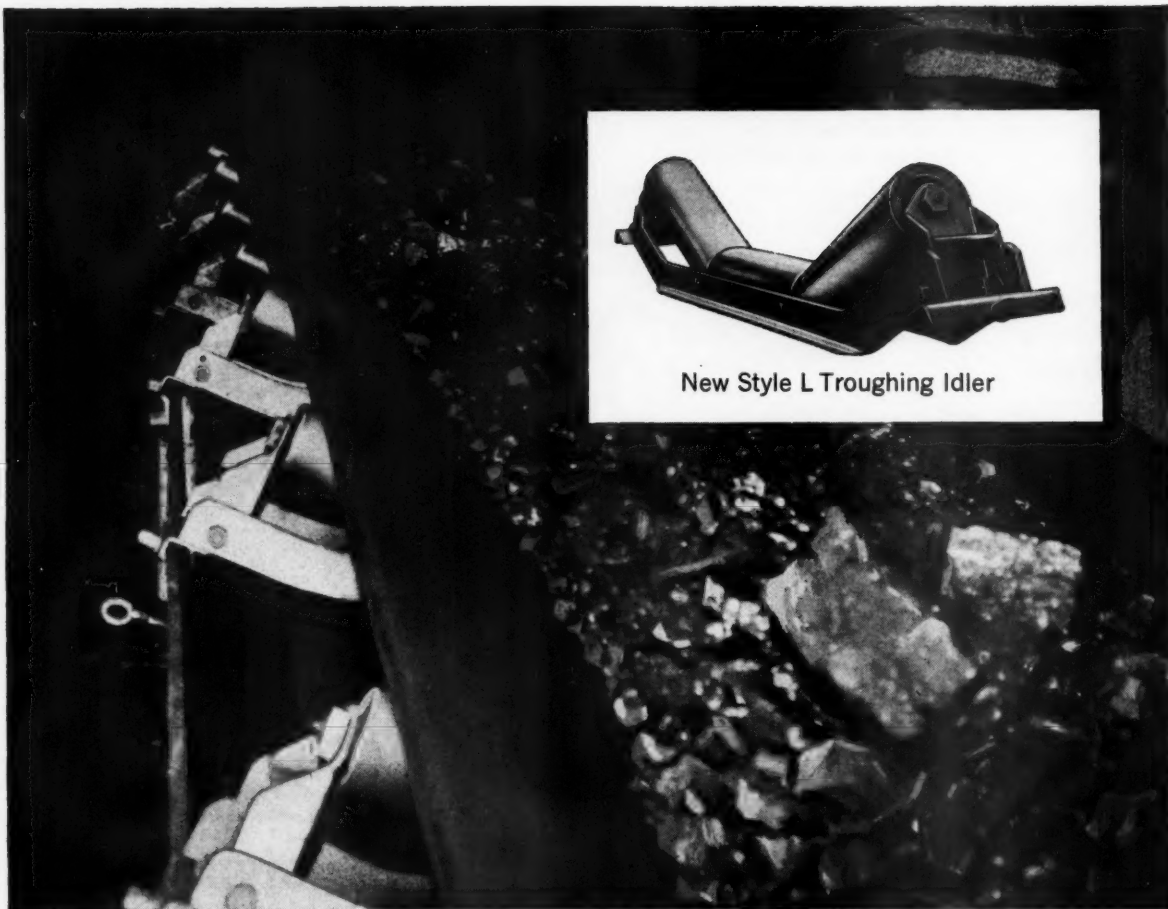
NAME _____

COMPANY _____

ADDRESS _____

CITY _____

STATE _____



New Style L Troughing Idler

H-R manufactures the broadest line of wire rope conveyors...

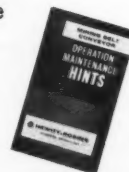
SEE ONE NOW!

Contact your H-R Field Engineer to arrange an inspection tour of an H-R wire rope conveyor installation in operation.

DESIGN RANGE:

- New Style L idlers—2¾" to 6" dia.
- Belt widths of 24", 30", 36", 42", 48".
- Speeds from 250 to 650 ft./min.
- Feed rates from 125 to 2,250 TPH.
- Power ratings from 5 to 300 hp.
- Above and below ground installation.

MONEY-SAVING HINTS! New pocket-size H-R booklet, packed with useful information on mining belt conveyor operation and maintenance. Write Hewitt-Robins, Stamford, Connecticut for Bulletin 4-17.



THE NAME THAT MEANS EVERYTHING IN BULK MATERIALS HANDLING SYSTEMS...
CONVEYOR BELTING AND IDLERS • INDUSTRIAL HOSE • VIBRATING FEEDERS, SCREENS AND SHAKEOUTS • POWER TRANSMISSION EQUIPMENT

personals

Hugo Riemer, former executive vice president, has been elected president of United States Borax & Chemical Corp. and **James M. Gerstley**, former president, has been named vice chairman of the board. In the newly created position of vice chairman, Gerstley will continue to serve the company with special responsibility for long range planning. Gerstley joined Pacific Coast Borax Co., predecessor to the present company, in 1933 as assistant to the general manager. When Pacific Coast and U. S. Potash merged in 1956 to form U. S. Borax he was elected president of the new organization.

Riemer joined the company as executive vice president in 1958. For the previous 23 years he had been associated with Allied Chemical Corp. and was president of the Nitrogen Division for the five years prior to joining U. S. Borax.

Charles B. Baton, president and a director of Baton Coal Co., has been elected a director of H. K. Porter Co., Inc. In addition to his posts with Baton, he holds similar positions with Greensburg Connellsville Coal & Coke Co. and the Farm Coal Co., as well as being an official in Joanne Coal Co., Carpentertown Coal & Coke Co., Bituminous Coal Operators Association, Western Pennsylvania Coal Operators Association, and Coal Operators Casualty Co.

E. H. Crabtree, director, Colorado School of Mines Foundation, has been elected a director of Mine & Smelter Supply Co., which for the first time in its 65-year history has elected directors from outside the organization. Crabtree's career spans 37 years of executive and research work in mining, milling and metallurgy. Since 1955 he has guided the growth and development of the School of Mines Research Foundation, prior to which he was deputy manager for the Atomic Energy Commission at Grand Junction, Colo.



Gordon H. Chambers, former chairman of the board of Foote Mineral Co., and **William H. Chisholm**, president of Oxford Paper Co. have been elected to the board of directors of the New Jersey Zinc Co.

Robert O. Jones, manager, Western Division, Standard Slag Co., has been elected a director.

Richard C. Cole has been named executive vice president and general manager of White Pine Copper Co., a wholly-owned subsidiary of Copper Range Co. For the past two years Cole has been vice president of manufacturing for Vitro Chemical Co., and vice president of Vitro Minerals Corp. Prior to that he was president and general manager of Vitro Uranium Co. Earlier Cole was with American Smelting and Refining Co. which he joined in 1941 as a junior metallurgist. He was assistant to the manager of ore purchasing for the company when he resigned to join Vitro Uranium in 1954.

E. M. Furness has been elected vice president in charge of operations, Reserve Mining Co. Since 1959 he had been assistant executive vice president, having been superintendent of crushing and concentrating at the company's E. W. Davis works for the previous four years. He joined Reserve in 1952 at its Babbitt, Minn., plant where he was in charge of the crushing and concentrating department. Before that he was concentrating superintendent at Lyon Mountain, N. Y., for Republic Steel Corp. In his new post, Furness will be responsible for Reserve's taconite mining and processing facilities at Silver Bay and Babbitt.



Erwin Gammeter, a vice president of Paul Weir Co., consulting mining engineers, has returned to this country after serving 27 months in South Korea. Gammeter was head of the company's coal mining mission

which formed the mining portion of a joint industrial group supplying technical assistance to the Republic of Korea. The coal mining team concerned itself primarily with anthracite deposits in the northeastern section of the country.

John A. Engstrom has been named general manager of El Potosi Mining Co. and its subsidiaries, representing the mining interests of Howe Sound Co., in



Mexico. Engstrom has worked for various companies in Butte, Mont., Ecuador, and Australia, and for the past nine years has been unit manager of the Topia and Avalos, Mexico, units, of Cia. Minera de Penoles, S. A., a subsidiary of American Metal Climax, Inc.

William E. Cotter, Jr., assistant to the vice president-operations, has been appointed to the newly created position of manager of sales for the Oliver Iron Mining Division of U. S. Steel Corp. Cotter joined the Oliver in 1946 as a clerk and advanced through various positions to become assistant to vice president-operations in 1956.

Eastern Gas & Fuel Associates has announced several personnel changes in the engineering department of its Coal Division.

R. L. Llewellyn, formerly preparation engineer, has been named manager of preparation and will be responsible for coal preparation plant and equipment engineering and design as well as the company's Product Control Department.



R. L. Llewellyn

Other changes in the company include the promotion of **Edgar Nash** from preparation engineer, High Volatile Coal Division, to product control manager succeeding the late James C. Johnson, and of **Curtis L. Burgess**, from general inspector to product control supervisor in the High Volatile Division. In the Low Volatile Coal Division, **Joseph T. Heatherman** has become product control supervisor while **Joseph C. Basile** has become product control supervisor for the company's northern division. Heatherman was formerly division preparation engineer and Basile was preparation engineer.

Peter Joralemon, consulting geologist, is directing the exploration program of New Zealand Mines Ltd., which is seeking new gold deposits in New Zealand. **A. M. Quennell**, former director of The Tanganyika Geological Survey, is acting as resident geologist for the company. **R. W. Osterstock**, consulting geologist, has worked with Joralemon in setting up the geochemical phase of the program. This program includes the use of magnetometers and seismographs as well as other methods of reconnaissance.

E. K. Olson, Jr., has become train and general foreman at the Bingham Canyon mine of Kennecott Copper Corp. Formerly safety director, he has been succeeded in that post by **Ronald J. Searle**, who had been division industrial hygiene field engineer.

Earl S. Mollard has been named vice president of mining operations, Hanna Mining Co., and general manager of mines, M. A. Hanna Co. He was previously general manager of the Riddle, Ore., operations of Hanna Mining Co. and Hanna Nickel Smelting Co. Mollard was manager of mines for Butler Brothers in Minnesota when Hanna took over that company's operations in 1948. He subsequently was named assistant general manager of Hanna's iron ore properties and was named to his posts in Oregon in 1952. **Emmons Coleman**, who had been manager of Hanna Smelting since 1953, succeeds Mollard at Riddle.



E. S. Mollard

P. V. Bethrum has been named superintendent of the 200-tpd uranium mill of Susquehanna-Western, Inc., at Falls City, Texas. He was previously foreman at the company's Riverton, Wyo., mill.

Arne E. Hill, superintendent of the Holman-Cliffs mine, Cleveland Cliffs Iron Co., has been named superintendent of the company's Empire mine on the Marquette range in Michigan.

Roger V. Pierce, Salt Lake City mining consultant, has been nominated to be president of the American Institute of Mining, Metallurgical and Petroleum Engineers in 1963. Pierce has been a consultant since 1948, prior to which he was associated with Ingersoll-Rand Co. in mine mechani-

zation work throughout the western hemisphere.

M. I. Signer, Jr., has joined United States Borax & Chemical Corp. in Carlsbad, N. M., as a senior mine engineer. He is former western phosphate project manager for International Minerals & Chemical Corp., having also spent several years as Canadian project manager for the company.

Robert L. Hair is retiring after 50 years of service with Colorado Fuel & Iron Corp. He is general superintendent in the company's mining department.

OBITUARIES

A. F. Howe, 88, president of Centrifugal & Mechanical Industries, Inc., died February 7 in St. Louis.



Mr. Howe was a pioneer in the application of centrifugal force for the removal of solids from a slurry. His centrifuges were among the first to be applied in the coal industry and are now being used throughout the world. He was also an internationally known authority on foundry practices and had a number of patents to his credit including one for moulding and casting a 65 ft locomotive frame in one piece.

Emil Deister, Sr., 88, founder and president of the Deister Machine Co., died in Fort Wayne, Ind., March 1. Mr. Deister was known throughout the mining industry for his accomplishments in the concentration of ores. He held a large number of patents covering improvements in separating equipment, especially ore concentrating tables and coal washing machinery. He founded Deister Machine Co. in 1912 and was active in company affairs until a few weeks before his death.



K. C. Li, 69, internationally known mining engineer and chairman of Wah Chang Corp., died March 7 in New York.

Mr. Li, a naturalized citizen, was born in China and educated at the Hunan Technical Institute, China, and the Royal School of Mines, London. A leading authority on tungsten, he

Ralph C. Toerper, former plant manager for Climax Uranium Co. at Grand Junction, Colo., has been named assistant director of research and development at the Langeloth, Pa., plant of Climax Molybdenum Co. He has been succeeded at Grand Junction by **Paul Wire**, who had been mill superintendent.

Robert E. Lee Hall, general counsel, National Coal Association, has been named to succeed **Tom Pickett** as director of government relations. Pickett is resigning from NCA to become vice president of the Association of American Railroads.

made the initial discovery of deposits of this metal in China. In 1915 he made the first shipment of Chinese wolfram to this country. Mr. Li served as an advisor on antimony to the allied and British governments during World War I, and as advisor on tungsten to the U. S. Government during World War II. He was a director of the Commodity Exchange, Inc., and of Howe Sound, Inc. Besides his professional affiliations, he had long been identified with civic affairs and was a director of the New York World's Fair Corp., 1964-66, at the time of his death.

G. Ralph Spindler, 58, well known mining educator and dean of the School of Mines at West Virginia University died in Morgantown, W. Va. on February 20.

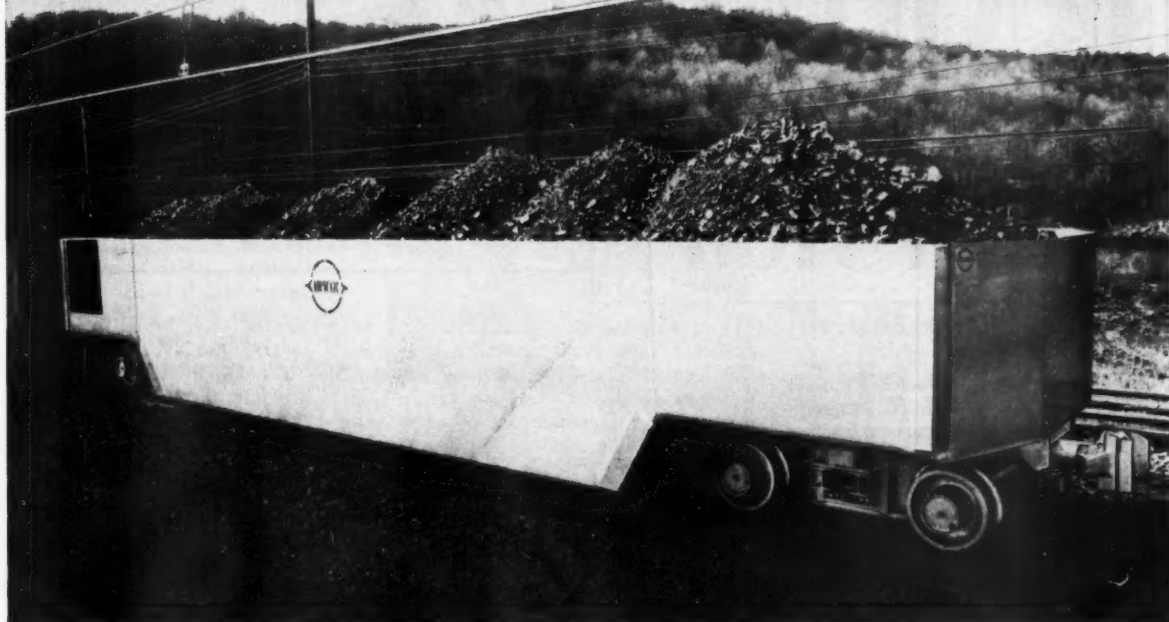
Dean Spindler had been head of the School of Mines since 1948 having joined the University's mining extension staff in 1935. He became assistant director of the School of Mines in 1939 and served during 1943 and 1944 as a mining consultant to the British Ministry of Fuel. From 1944 to 1948, he was chief of the West Virginia State Mines Department.



John E. Dunn, 64, special representative in Allis-Chalmers processing machinery department, died February 17 in Milwaukee, Wis.

Mr. Dunn, who was widely known in the coal and stone products fields as an authority on vibrating screens, had been associated with Allis-Chalmers since 1913. Prior to being named to the position of special representative, he had been engineer-in-charge of the screen section.

Irwin chooses Timken® bearings for its first aluminum mine cars



result: more cars per trip — more trips per car

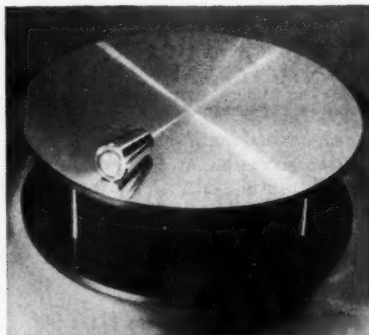
Now Irwin-Sensenich Corporation offers its first aluminum mine cars and they're all on Timken® tapered roller bearings. With these light-weight, yet strong aluminum cars, coal operators can haul more cars per trip, save on power and labor. And because the wheels are on Timken bearings, miners can count on making more trips per car with less maintenance.

With Timken bearings you can be sure of reliable performance. One reason is their uniform high quality.

Another is their tapered design that takes *both* radial and thrust loads. And full-line contact between rollers and races gives extra load-carrying capacity. Because Timken bearings have low internal stresses and true rolling motion, they practically eliminate friction. Cars start and roll easier, save power. And because natural pumping action moves lubricant through the bearings, with no outer race grooves to trap dirt, maintenance is reduced. Timken bearings roll trouble-free, longer.



ON THE SPOT—that's how bearing problems are often solved by Timken graduate sales engineers. They'll work with you at the design stage, help you select the most economical bearing for your requirements.



ROLLS FOREVER in the same circle. This oscillating table demonstrates the accuracy of the taper of a Timken bearing roller. And precision manufacture assures true rolling motion.



The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits. Canadian Division: Canadian Timken, St. Thomas, Ontario.

Call on us at the 1961 Coal Show, Cleveland Public Auditorium, May 15-18, Booth 900.

NEWS and views



American Metal Climax Foundation Establishes Fellowship

American Metal Climax Foundation, Inc., has established graduate fellowship in nonferrous extractive metallurgy at Columbia University, Purdue University and the University of Missouri, School of Mines and Metallurgy. Each grant is valued at about \$4000 a year. Selection of the fellowship candidates and control of the grants are being left entirely at the discretion of the respective schools.

Purpose of the three grants is to contribute to the advancement of education in metallurgy, and to give recognition to the outstanding contributions to the science of metallurgy already made by distinguished faculty members at the designated universities. Those honored are:

Herbert H. Kellogg, professor of Mining Engineering at Columbia University, well known for his work in the thermodynamics of metallurgical reactions.

Reinhardt Schumann, professor of Metallurgical Engineering at Purdue University and chairman of the division. He is noted for his research in the physical chemistry of flotation and extractive metallurgy. Albert W. Schlechten, chairman of the Department of Metallurgical Engineering at the Missouri School of Mines and Metallurgy, who has been particularly active in the advancement of vacuum metallurgy and the metallurgy of titanium and zirconium.

Consol Acquires Crucible Mine

Consolidation Coal Co. has acquired from Pittston Co. the Crucible mine, formerly owned by Crucible Steel Co. The mine is located at Crucible, Pa.

The property has been acquired to

provide Consol with additional reserves of high quality, metallurgical coal located near Pittsburgh on the Monongahela River. No plans are in prospect for immediate operation of the presently idle mine.

Cerro Plans \$8,400,000 Tunnel at Peruvian Mine

Cerro Corporation's major mining subsidiary, Cerro de Pasco Corp., plans to undertake an \$8,400,000 tunnel project at the Casapalca mine in Peru. The new project, to be named the Graton Tunnel, will permit Cerro to mine extensive silver, lead and zinc ore bodies not now worked because of underground flooding. Driving of the tunnel will begin this year and take about five years to complete.

The Casapalca mine is now being worked to a level 930 ft below its main adit, which is located at an elevation of almost 14,000 ft above sea level. Lower reaches are not being mined because of flooding by hot water which originates deep within the Andes Mountains. The Graton project, which will consist of two parallel seven-mile bores 30 to 60 ft apart and some eight ft in diam, will allow mining to continue to a depth 2400 ft below the present limit. One of the bores will remove the hot water from the deeper working levels of the mine and make accessible ore bodies that could not be developed under present conditions. The other bore will permit cool air to be drawn in from the portal and in addition will be used for haulage during tunnel driving operations.

Peabody Announces Plans for 85-Yd Dragline

Peabody Coal Co. has formulated significant plans for property development over the next three years. These plans involve a minimum expenditure of \$50,000,000 over the period and include the construction of the new mine

near Paradise, Ky., which will serve the 65,000,000 ton TVA contract.

Also included in the plans are an 85-yd dragline, the largest ever built, and a duplicate of the 115-yd shovel being constructed for the Paradise mine. These giant stripping machines will increase the company's strip reserves substantially.

The principal projects involved in this program are scheduled for completion in the latter part of 1962 and 1963.

Steam Generating Facilities Proposed in West Virginia

The Public Service Commission recently conducted a formal hearing on an application by Virginia Electric & Power Co. for authority to build and operate on Stony River in Grant County, W. Va., a steam generating station with an ultimate capacity of about 1,00,000 kw. Initial construction is planned to be either a 250,000 kw or a 300,000 kw unit, and the company would expect to complete the proposed facility in about eight to ten years. A desire to cut total fuel cost has been the primary reason in the company's decision to build a generating plant in West Virginia.

The PSC was told that the proposed construction of a \$150,000,000 electric generating plant in Grant County promises to open up a new coal producing area in eastern West Virginia. The station ultimately expects to use 2,500,000 to 3,000,000 tons of coal per year and will create a substantial market for the fuel available in the Grant County area.

Reading Anthracite Sold

The Philadelphia & Reading Corp. has sold Reading Anthracite Co., its coal producing, coal selling subsidiary, to John B. Rich, Pottsville, Pa., owner of Gilberton Coal Co. The

(Continued next page)

(Continued from previous page)

sale included the coal lands, breakers, equipment, inventory and supplies, as well as a small amount of bank coal. It also included rights to the name Reading Anthracite Co. and to the trademark "Famous Reading Anthracite." The subsidiary will change its name to Reading Carbon Co., and George J. Clark will continue as president.

Dunn Reports on ILO Conference

Stephen F. Dunn, president of National Coal Association, recently returned from Geneva, Switzerland, where he served as United States Employer delegate to the International Labor Organization Tripartite Technical Meeting on the "Social Consequences of the Crisis in the Coal Mining Industry."

He said that delegates to the ILO Conference reached conclusions which he considered most important as far as the United States is concerned. Among these are:

1. That "... despite the appearance of new sources of energy on a large scale, coal remains, and will remain for a long time to come, the most important source of energy and primary product in the modern economy."

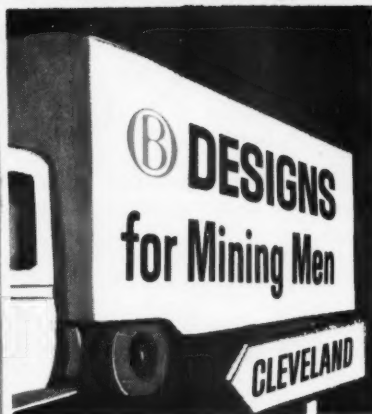
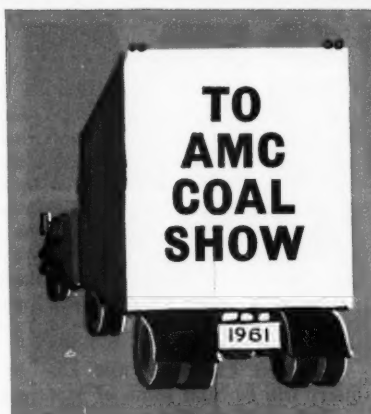
2. That "... the attention of the governments should be drawn to the paramount need to promote in each country concerned, a policy to enable the coal mining industry to maintain an essential position within each national economy."

3. That "... the current crisis in the coal mining industry of the various nations is due to competition of other fuels and to cyclical variations in demand."

4. That "... the current state of crisis, despite its seriousness, in no way implies that the existence of the coal mining industry, even in the more distant future, may be in question."

In addition to their recognition of the problems created by the oversupply of oil in the world, Dunn said, all of the ILO delegates recognized the need for fuel policies in the various countries to conserve national resources. They also took note of the necessity of free interchange of marketing and research information.

Other American delegates to the ILO Conference were Paul K. Reed, special international representative of the United Mine Workers of America, and Harry Weiss, executive director of the Manpower Administration, U. S. Department of Labor.



accept our invitation
...JOIN US!

Ohio Brass

10055-M

EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY
AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS



ALSO . . .

Bethlehem Steel Co. has announced plans to construct one of the country's largest tar distillation units at its Sparrows Point, Md., steel plant. Announcement followed completion of preliminary arrangements between Bethlehem and Allied Chemical Corp. for erection of the new facilities to recover chemicals from coke-oven tar for processing in Allied's facilities at Philadelphia. Current plans call for first production to reach the market late this year.

An all-aluminum submarine is scheduled to make its debut next year. Plans have been virtually completed with Electric Boat Division of General

Dynamics Corp. to construct such a craft for use in Navy oceanographic research. The new type submarine will be 50 ft long and seven ft in diameter, and will use about 75 tons of aluminum including hull plates about 6½-in. thick. The *Aluminaut*, as it will be known, will be owned by Reynolds Metals Co. which will lease it to the Navy Department on a long term basis.

Eastern Canada's first zinc refinery will be built south of Montreal in Valleyfield to process concentrates from the new Mattagami Lake mining camp about 350 miles northwest of Quebec. The refinery, which would have a capacity of about 165,000 tons of zinc annually, is a project of Mat-

tagami Lake Mines Ltd., a company controlled by Noranda Mines, McIntyre Porcupine Mines and Canadian Exploration Ltd.

The Athletic Mining & Smelting Co. plant at Fort Smith, Ark., which has been closed since December 1959, has reopened and is operating at 40 percent production capacity. The smelter was closed because of an insufficient supply of zinc concentrates.

About 3000 carats of diamond drill material were recently sent the U.S.A. as a gift to the National Academy of Sciences by Industrial Distributors (1946) Ltd. for use in Project Mohole. Ultimate goal of this venture is to drill through the earth's crust under the ocean to determine the composition and physical properties of the crust and of the underlying rock known as the mantle. The diamond drill stones were turned over to American manufacturers who will produce drill crowns for the tests. One of the manufacturers, Christensen Diamond Products Co., is designing and producing bits as a contribution to the drilling project.

Olin Mathieson Chemical Corp. recently announced that it had developed a commercially practical way of making aluminum from common clay. However, the company did not disclose any plans to exploit the new process commercially. Olin's acid process opens the possibility of placing a complete aluminum plant on one site where coal for electric power is cheap, because the shales associated with most coal could be an excellent source of alumina, according to the report.

Maust Coal & Coke Corp. has taken over the operation of Bird Coal Co. A sale has not been consummated, but the Maust interests will run Bird No. 2 mine at Tire Hill and Bird No. 3 mine at Riverside, Pa.

Chesapeake & Ohio Railroad Co. is making heavy repairs to 1000 coal hopper cars, turning them out at the rate of ten a day to assure coal shippers a continued good car supply.

In its annual report **Peabody Coal Co.** announced that the Joy Electronic Push-button Miner has been erected and is now being tested at the Simco-Peabody mine, Coshoc-ton, Ohio. Limited alterations are being made as the result of these initial tests.

(More News and Views on Page 104)

Introducing a new service to the Mining Industry!

Rebuild

YOUR PRESENT DRUM

at your mine site

WITH LEBUS GROOVING

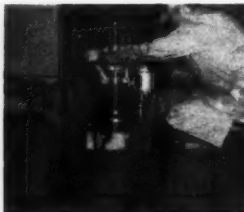
and at the same time obtain LeBus Controlled Spooling for multilayer spooling operations

- Change your cast iron drum core and flanges to steel
- Change groove size for larger lines when going deeper
- Increase wire line service over any present multilayer spooling
- Eliminate cutting through of line and excess scrubbing at the crossovers

See Exhibit
Booth 141 Arena
Coal Show
May 15-18
Cleveland, Ohio



(1) This view shows one method of removing tapered wedges or end fillers on helical grooved cast iron drum.



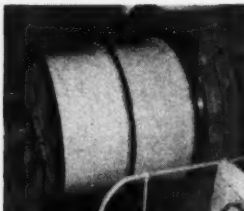
(2) Shows process of drilling a steel sleeve to be bolted to a cast iron drum.



(3) Shows installation of steel sleeves and steel wire plates on the flanges and welding the sleeves and plates firmly together giving a complete steel drum core and flanges.



(4) Shows installation of LeBus grooved segments to the steel drum core by the process of welding.



(5) Completed installation showing LeBus Counterbalance Spooling System installed on a 72" by 36" double drum for 1-1/4" line.



(6) View shows overwind and underwind spooling operation where 3 and 1/2 layers of 1-1/4" line are being spooled on to the drum.

Five more skips per hour have been made possible by installation of this LeBus Counterbalance Spooling.



LEBUS INTERNATIONAL ENGINEERS, INC.

Box 2352, Longview, Texas

Phone: Plaza 8-5522

Fairmont Machinery Company
P.O. Box 992 Telephone 1-672
Fairmont, West Virginia

Selman and Company
P.O. Box 2388 Fairview 4-0625
Birmingham, Alabama

Western Machinery Company
P.O. Box 1498 Chapel 2-1983
Grand Junction, Colorado

Western Machinery Company
P.O. Box 2548 (Hagerman) 2-1983
Salt Lake City, Utah

The Coeur D'Alenes Co.
Wallace, Idaho

WHEELS OF GOVERNMENT

(Continued from page 93)

economically depressed areas, but have disagreed on the method of financing the program.

The Senate version would permit the funds to be borrowed directly from the Treasury; the House version would require Congressional appropriation of the necessary funds. Until the dispute is settled by a conference committee, the bill cannot be sent to the President for signature.

The measure, high on the President's list of "must" legislation, is aimed at encouraging construction of new and expanded industrial and public facilities in areas of chronic depression.

GOVERNMENT EXPANDS MINERAL EXPLORATION AID PROGRAM

Interior Secretary Udall has expanded the program under which the Government provides financial assistance to private industry in the exploration for minerals. The Secretary said the revision is designed to strengthen the domestic mining industry and to aid depressed areas.

This program, authorized by Congress in 1958 and administered by the Office of Minerals Exploration, permits the Government to furnish part of the cost of any approved exploration project—subject to a ceiling of \$250,000 on the Government's share in any single contract. These contracts call for repayment of amounts advanced, plus interest, by royalties on any commercial production resulting from the project. Until now, 32 minerals have been on the eligible list, with the Government's share of the cost of any project limited to 50 percent.

In his recent move, Udall added six minerals to the eligible list—gold, silver, iron ore, bismuth, sulphur and tellurium. He also raised to 75 percent the amount of Government participation in projects covering asbestos, bauxite, beryllium, chromite, columbium, corundum, industrial diamond, crucible flake graphite, strategic kyanite, manganese, mercury, strategic mica, nickel, platinum group metals, piezoelectric quartz crystal, block statite talc, tantalum and tin.

Minerals subject to the 50 percent limitation, in addition to the six just added to the eligible list, are antimony, cadmium, cobalt, copper, fluor spar, lead, molybdenum, monazite, rare earths, rutile, selenium, thorium, uranium and zinc.

(News & Views continued on page 104)

MINE-POWER

by Steve Bunish

whose many years of practical experience underground followed by developmental work at Anaconda has made him a recognized authority on mining cables.



Steve Bunish answers your questions on mine cable application and maintenance.

#1: premature failure of trailing cables

Dear Steve,

We take all the routine precautions with our trailing cables—keep them off sharp edges, try to avoid overloading them—but the cable doesn't hold up as long as it should. Our only clue to these failures is little knots that show up in the jacket, but the cable doesn't fail until some time after these bumps appear. What are we doing wrong?

R.T.M., West Virginia

Dear R.T.M.

It sounds as if your cables are failing through excessive tension. Stretching a cable and then releasing it creates two different problems, both of which shorten cable service life.

When a cable is stretched, the conductors, insulation, and jacket are damaged. The stranded conductor is subjected to compression and shear forces, which weaken it. The insulation becomes very vulnerable to compression cutting, especially when the tight cable is run over and the insulation crushed against the stranded conductor. The jacket is also easier to tear and cut when the cable is stretched.

Release the tension on a stretched cable, and you set up different problems. The jacket and insulation are more elastic than the conductors, so they tend to go back to their original "pre-stretch" length. But once the conductor is stretched, it stays that way. Result: the jacket and insulation pull the conductor into kinks, which show up as bumps or knots in the jacket. These kinked spots won't necessarily break right away, but they're potential trouble spots that will fail pretty soon.

The only way to get around this problem is simply not to stretch the cable. Once the bumps appear, the damage is already done, and it's quite a price to pay for temporarily getting a few extra inches of reach out of a cable.

61254

Steve Bunish will be glad to answer your minepower problem. Simply write it up and send it to "Minepower," c/o Steve Bunish, Anaconda Wire and Cable Company, 25 Broadway, New York 4, N. Y.

See the man from
ANACONDA
for Mining Cables

In recognition of its "National Goals" advertising program to stir public awareness of the country's growth needs in various fields, Caterpillar Tractor Co. has been awarded the 1960 George Washington Honor Medal by Freedoms Foundation at Valley Forge. Headlined "He's Digging for Nails," the December advertisement discussed the country's accelerating use of metal ores and was typical of the entire series. It was intended to develop public interest in and support for the steps necessary to meet the expanding needs for ore.

The board of directors of Copper Products Development Association have elected to membership six more copper producers. They are: Bancroft Mines Ltd., Salisbury, S. Rhodesia; Campbell Chibougamau

Mines Ltd., Toronto; Nchanga Consolidated Copper Mines Ltd., Salisbury; Sherritt Gordon Mines Ltd., Toronto; Rhokana Corp., Ltd., Salisbury; and Union Miniere du Haut-Katanga, Brussels. These new members bring the total membership of C.P.D.A. to 31 companies, who produce more than 90 percent of the free world's copper.

Republic Steel Corp. has reopened its Lyon Mountain, N. Y., iron ore mine and its blast furnace at Troy, N. Y. The mine has been shutdown since November 11 and operations at Troy were suspended December 1.

The Sixth Annual Appalachian Underground Corrosion Short Course will be held June 6, 7 and 8 at the West Virginia University. The course is organized to provide both technical and nontechnical presentations of the practical and theoretical aspects of the causes of corrosion, instrumentation, corrosion surveys, cathodic protection, pipe coatings, and miscellaneous methods of corrosion control. The course is designed for any personnel whose work may require practical knowledge of underground metallic

corrosion. Also included in the course agenda are field demonstrations of control corrosion equipment, a three-hour corrosion control open discussion and exhibits of materials and equipment. For advance registration information write R. E. Hanna, Jr., The West Virginia University, School of Mines, Morgantown, W. Va.

Reynolds Metals Co. has reached an agreement to buy the electrical conductor manufacturing equipment of John A. Roebling's Sons Corp., Division of Colorado Fuel & Iron Corp. Not included in the Roebling sale are nine open hearth furnaces which have an annual capacity of 235,000 tons of steel.

The S. S. Marine Sulphur Queen, an ocean-going tanker capable of hauling 15,100 tons of molten sulphur, was recently put into service. It is the first ocean-going vessel in the sulphur industry devoted exclusively to the transport of molten sulphur. The tanker will be used by Texas Gulf Sulphur Co. to transport sulphur from its main storage and loading terminal at Beaumont, Texas, to two new molten sulphur terminals at Carteret, N. J., and Norfolk, Va.

WANTED . . . SALES ENGINEER:

Excellent opportunity for graduate mining engineer (25-35) with experience in coal mine production, engineering, or selling of mining equipment, to work for major manufacturer of underground machinery. Send resume in full confidence to: Box 361, MINING CONGRESS JOURNAL, 1102 Ring Bldg., Washington 6, D.C.

AMERICAN AIR SURVEYS, INC.



Aerial Topo Maps
Aerial Photos & Mosaics
Plan & Profile
Tax Maps

907 PENN AVE., PITTSBURGH 22, PENNA.
BRANCHES: MANHASSET, N.Y. • ATLANTA, GA.
A Nationwide Service

THERON G. GEROW

Mining Consultant and Engineer

3033 Excelsior Boulevard
Minneapolis 16, Minnesota

MOTT CORE DRILLING CO.

Contractors

Exploration of Coal Properties. Guarantee satisfactory coal cores. Inside Mine Drilling. Pregrouting. Mine Shafts. Large diameter holes.

828-846 — 8th Avenue
Huntington 17, W. Va.

J. W. WOOMER & ASSOCIATES

Consulting Mining Engineers

Modern Mining Systems and Designs
Foreign and Domestic Mining Reports

HENRY W OLIVER BLDG.
Pittsburgh, Penna.

There's 1000 good reasons why
you should attend THE COAL SHOW
Cleveland, Ohio, Auditorium, May 15-18!

VISIT US AT BOOTH

1,000

ABC
Brattice
Cloth

ABC
MineVent
Tubing

ABC
MineDuct
Tubing

ABC
Trolley Guard
and Powder Bags

See Why The ABC Line Has Made Thousands
of Friends!



AMERICAN
BRATTICE CLOTH CORP.

310 King's Highway

Warsaw, Indiana

THE REPORT CORNER

Recent Publications of Interest to Mining Men

USBM IC 8001. "American Standard Practice for Rockdusting Underground Bituminous-Coal and Lignite Mines to Prevent Coal-Dust Explosions (ASA Standard M13.1-1960, UDC 622.81)," sponsored by Bureau of Mines. Publications-Distribution Section, Bureau of Mines, 4800 Forbes Ave., Pittsburgh 13, Pa.

"Proceedings—The National Conference on Water Pollution," Public Health Service, U. S. Department of Health, Education, and Welfare. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price: \$2.25 (paper).

USBM IC 7984. "Fluorspar Mining Methods and Costs, Ozark-Mahoning Co., Hardin County, Ill.," by Harold Bailie, E. Powell, William Melcher, and F. J. Mylinski. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price: 30 cents.

Bulletin No. 18. "Minerals of Indiana," by Richard C. Erd and Seymour S. Greenberg. Publications Section, Geological Survey, Indiana Department of Conservation, Indiana University, Bloomington, Ind. Price: 75 cents plus 10 cents for packaging and mailing for orders under \$1.00 and 10 percent for orders over \$1.00.

"Cost Comparison of Various Coke Production Methods," Shallway Corp., 533 Shelbourne Ave., Pittsburgh 21, Pa. Price: \$7.50.

"Special Report on the Oxidation of Pyritic Conglomerates," by S. A. Braley. Office of Public Relations, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.

"Three Studies in Minerals Economics," by Orris C. Herfindahl. Resources for the Future, Inc., 1775 Massachusetts Ave., N. W., Washington 6, D. C. Price: \$1.00.

Bulletin 57, "Geology of the White Pine Mining District, White Pine County, Nevada," by Dr. Fred L. Humphrey. Nevada Bureau of Mines, University of Nevada, Reno, Nev. Price: \$3.50 plus 15 cents to cover postage and handling costs.

Circular 310, "Coal in the Future Energy Market," by Hubert E. Risser. Illinois State Geological Survey, Urbana, Ill.

"American Standard Radiation Protection in Uranium Mines and Mills (Concentrators) N7.1-1960." American Standards Association, Dept. PR 211, 10 East 40th St., New York 16, N. Y. Price: \$2.00.



TODAY'S MOST PRECISE LEVELING INSTRUMENT for field, industrial and engineering requirements. Indispensable for structural settlement and load studies...for jig and fixture alignment...for setting turbines, generators and other heavy machinery, and all first order leveling. The WILD N-3 is dependable, rugged, easy to set up and use. Models for reading direct to .1 mm; .001"; .0005". All have tilting screw, coincidence level and built-in optical micrometer.



**WILD
HEERBRUGG**

**WILD N-3 HIGH
PRECISION LEVEL**

One of a complete line of superb instruments for Surveying, Photogrammetry and Microscopy. Write for Booklet N-3.

WILD HEERBRUGG INSTRUMENTS, INC. • PORT WASHINGTON, NEW YORK
In Canada: Wild of Canada Ltd., 157 MacLaren St., Ottawa, Ontario

Get **DOUBLE EXPANSION** for **DEPENDABLE** roof support with **PATTIN** roof bolts and expansion shells



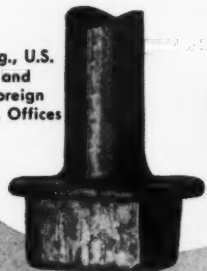
STYLE
D-1

The unique double expansion feature of all Pattin expansion shells insures dependable roof support, in hard or soft roof conditions. Their double holding power guards against failure — even under a 20 ton pull!

Pattin features include a parallel contact with the hole, and no definite drilling depth is required, as the shell can be securely anchored at any place in the hole. They anchor solidly and will not turn while being tightened. Wedge and shell are assembled in a manner to prevent loss of parts in handling, and the bolt and shell assembly are furnished as a complete unit. Plates are bundled separately. No special nuts or ears are required on the bolts. These features make a safer roof — and a safer roof means fewer accidents, increased production, more clearance for equipment operation and better ventilation.

Pattin specializes in roof bolting — it's our business, not just a sideline! Your business is important to us, and our service engineers are always available for consultation on your roof problems — ready to give you service when you need it! **WRITE OR PHONE US TODAY** for complete details.

Reg., U.S.
and
foreign
Pat. Offices



IN WESTERN STATES

Pattin expansion shells are available and serviced exclusively by Colorado Fuel and Iron Corporation, Denver, Colorado. Western mining companies should contact them direct for information and consultation.



The **PATTIN** split-type **BOLT**

The split-type bolt is one of the first slotted bolts, and continues to be a favorite wherever split-type bolts are used. Many mines still prefer this type. The bolt is a full 1-inch in diameter, with cut threads and furnished with hex or square nuts and various size plates and wedges.

PATTIN

MANUFACTURING COMPANY
MARIETTA, OHIO

The **PIONEER** of roof bolting . . . established 1888

ENV ALSO . . .

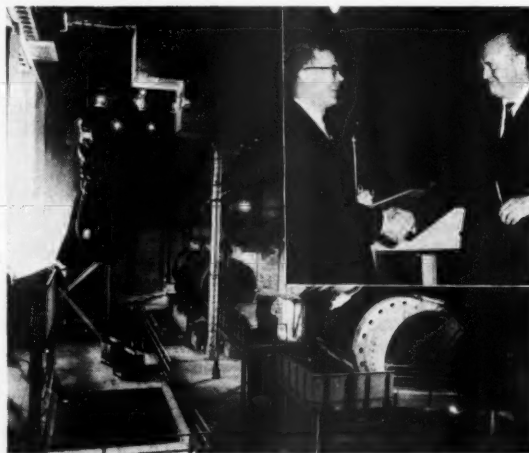
Crucible Steel Co. has sold its river fleet consisting of a tow boat, *M. V. Crucible*, 55 barges, and miscellaneous barge repair facilities to Island Creek Fuel & Transportation Co.

The School of Mines at West Virginia University, Morgantown, W. Va., through its Department of Mining Extension, will offer the 11th Annual Short Course in Coal Preparation June 12 to July 21, 1961. The course objective is to provide an understanding of basic techniques in coal preparation and their application to present day coal cleaning problems including modification to existing plants, upgrading fine sizes, and clarification of washery water and stream pollution. Additional information may be obtained by writing to the School of Mines.

The Hanna Mining Company's \$2,000,000 pilot plant in Minnesota has begun testing the commercial feasibility of beneficiating semitaconites. Other research facilities are being expanded to include long-range study of flotation methods for improving nonmagnetic iron ores and methods of agglomeration.

INCO GOES INTO PRODUCTION AT ITS THOMPSON, MANITOBA, PROJECT

A new plant, including mine, mill, smelter, refinery and townsite, was dedicated on March 25th with a special ceremony at International Nickel Company's property 400 miles north of Winnipeg. Insert shows Chairman Henry S. Wingate (right) greeting Hon. Duff Roblin, Premier of Manitoba, who is about to cut the pure nickel ribbon signifying the start of operations at the Thompson Project, named after John F. Thompson, Honorary Chairman of Inco.



The converter aisle, a section of which is shown above, will feed molten nickel matte to casting machines that will make anodes for the refinery at the rate of 75,000,000 pounds of pure nickel per year. As a result of this new facility the free world is assured an ample supply of the vital metal for all applications. By bringing another major nickel deposit into production, Inco will be able to relieve the pressure on its facilities at Sudbury, Ontario, and substantially extend its ore reserves in that district.

A long-term lease plan, under which special-body trucks used in the mining industry can be leased without maintenance for from four to eight years, has been announced by Wheels, Inc., Chicago, Ill. There is no limit to the type of special bodies and chassis which can be leased under this plan, according to the company. Units can be engineered to the most rigorous specifications to meet the most unique service requirements. In this way companies can be relieved of the need to invest considerable working capital in these costly units of transportation equipment. In order to qualify for a special-body truck lease, a company must have a net worth of \$1,000,000 and a record of profitable operations.

The Office of Minerals Exploration of the U. S. Department of the Interior recently approved an exploration assistance contract with Roland F. Beers, Inc., of Troy, N. Y., to explore for nickel in Knox County, Me. Total cost of the work authorized under the contract is estimated at \$18,186 of which the maximum Government participation is \$24,093. This is the first OME contract for work in Maine, and it is also the first for nickel which is one of the 32 mineral commodities eligible for exploration assistance.

Dr. B. J. Kochanowsky, associate professor of mining engineering at Pennsylvania State University, has been assisted in his research on blasting with grants of \$3000 from Joy Manufacturing Co., \$4000 from Peabody Coal Co., and \$1000 each from National Lead Co. and E. I. DuPont de Nemours & Co. Laboratory experiments with mine models and small charges of explosives are being conducted by graduate students to determine the degree of fragmentation, throw, and blasting efficiency with inclined drill holes of varying spaces and burden. Dr. Kochanowsky has done considerable work on this method of blasting used in surface mining.

A commercial - size research project of autogenous-grinding of low grade iron ore will be conducted near Ishpeming, Mich. this summer by Cleveland-Cliffs Iron Co. The ore will come from the Empire mine about three miles southeast of Ishpeming, and tests will be conducted at the nearby New Volunteer mine. Utilizing a Cascade mill, the test will determine the commercial mill size and horsepower requirements.



EASIEST WAY TO
MAKE ENDS MEET

VICTAULIC®

The Time-and Job-Proven Method of Reducing Piping Costs

Let the Victaulic Method save you money on piping costs. Whatever piping material you choose, Victaulic can join it and provide fittings. You save in material cost, in installation time, and in reduced piping maintenance cost.

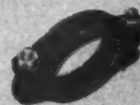
CUT COSTS WITH OVER 1100 VICTAULIC ITEMS
FOR BETTER AND EASIER PIPING



Standard Couplings



Lightweight Couplings



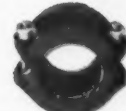
Rigid Couplings



Roust-A-Bout Couplings



Snap-Joint Couplings



Plainlock Couplings



Malleable Iron Fittings



Stainless Steel Fittings



Aluminum Fittings



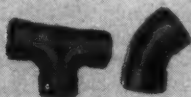
Plastic Fittings



PVC Lined Fittings



Cast Iron Fittings



Plainlock Fittings



Vic-Groover Tools



Vic-Easy Tools

For complete information on any Victaulic product, write:

VICTAULIC
COMPANY OF AMERICA

Dept. 34-4, P. O. Box 509, Elizabeth, N. J.



Plug Valves

NEWS and views



Fellowships for Graduate Research in Mining Announced

The mining department of the University of California at Berkeley has received a \$1,500,000 bequest from the estate of the late Martin J. Heller to establish fellowships for graduate research in mining and mining engineering. Heller was a mining engineering graduate from the school. The fellowships are for an 11-month period and range from \$3500 a year on the Masters' level to \$4500 a year on the Doctoral level. Graduates from recognized engineering schools throughout the world are eligible to apply for the fellowships which will be for work toward advanced degrees in mining engineering, mining geophysics, mining geochemistry, mineral exploration engineering, and certain phases of mineral beneficiation and extractive metallurgy.

AEC U₃O₈ Purchases in 1960

Domestic uranium concentrate purchases by the Atomic Energy Commission in 1960 amounted to 17,753 tons U₃O₈, of which 17,637 tons, valued at about \$305,000,000, were produced in 25 ore processing mills in the Western United States. The leading State was New Mexico, which produced 45 percent of the total from six mills, followed by Colorado with 18 percent from seven mills. Seventeen percent came from Utah's three mills and 16 percent from Wyoming's five mills, while a total of four percent was produced at four mills in Arizona, Washington, South Dakota and Oregon. The Commission also purchased about 100 tons of U₃O₈ produced as a by-product of phosphate rock processing in Florida and Illinois and about ten tons derived

from the treatment of Idaho euxenite at St. Louis.

Unpatented Claims Purchased by P.D.

Phelps Dodge Corp. has purchased 299 unpatented copper mining claims in the Lone Star Mining District near Safford, Ariz., for \$3,500,000. The claims are adjacent to 195 claims located by Phelps Dodge in 1957. Mining operations are not contemplated until some time in the distant future. There has been considerable interest shown in the Safford area in recent years. Currently Kennecott Copper Corp. is sinking a two-compartment vertical development shaft at a property four miles distant from the Phelps Dodge claims.

Safety Glasses Program Pays Off

Employees at Homestake Mining Co. completed 1960 without suffering a single eye injury. The company's safety goggle program, which was inaugurated in 1954, requires that all underground and surface workers wear safety glasses at all times. For the six years preceding 1954, there was an average of 19 lost-time eye injuries per year. From 1954 to 1959, this average was reduced to three per year.

Million Ton Ore Body Disclosed

Underground drilling by Kennecott Copper Corp. at the Tintic Unit mine near Eureka, Utah, has thus far revealed an ore body containing in excess of 1,250,000 tons of ore with weighted assays showing 15 percent lead, 12 percent zinc and 10 oz. of silver per ton. Drifting in one area of the mine has also indicated the presence of ore in what may be the Eureka

Standard fault, which in former years was an important gold producer. Kennecott has been sinking a winze at the property to determine ore continuity at depth as well as evaluate ground conditions. The company acquired its interest in the Tintic unit last year from its exploration subsidiary, Bear Creek Mining Co., which has been actively investigating the district for several years.

Will Begin Sand Filling

Bunker Hill Co. will initiate a sand-filling system using mill tailings at its Kellogg, Idaho, mine. Preparatory work for the new system is expected to be completed in July. Waste rock previously used for stope fill will be removed from the mine necessitating greater hoisting capacity. To attain this, ten-ton capacity skips will replace the present eight-ton units. Mill tailings will be partially deslimed in cyclones before being pumped about two miles into the mine. In the mine, they will be cycloned again for removal of surplus water and the remaining slimes. The material will be stored in a 370-ton tank and repulped to 70 percent solids when needed for stope fill.

ALSO . . .

A new shaft is being sunk at the Goldfield, Nev., property of Goldfield Consolidated Mines Co. as one phase of a development project being conducted by American Exploration & Mining Co. The shaft is near the Hayes-Monette Lease which was an early gold producer. A new ore body is believed to have been located as a result of drilling.

IT'S A FACT*



***Longyear**
offers you
70 years
experience
in contract
drilling

Experienced and capable crews, plus modern methods and equipment, combine to offer you prompt, efficient Contract Drilling Services. Quotations furnished promptly and in strict confidence. For more information, contact our nearest office.

E. J. LONGYEAR CO.



Longyear Building
Minneapolis 2, Minn.

P. O. Box 245
Max Meadows Va.

1533 W. Mulberry Dr.
Phoenix 15, Ariz.

P. O. Box 18
Poplar, Wis.

ADV-174A

APRIL 1961

NOW...CONNECT BELTS OF DIFFERENT THICKNESSES WITH ONE TYPE OF FLEXCO® HINGED FASTENER

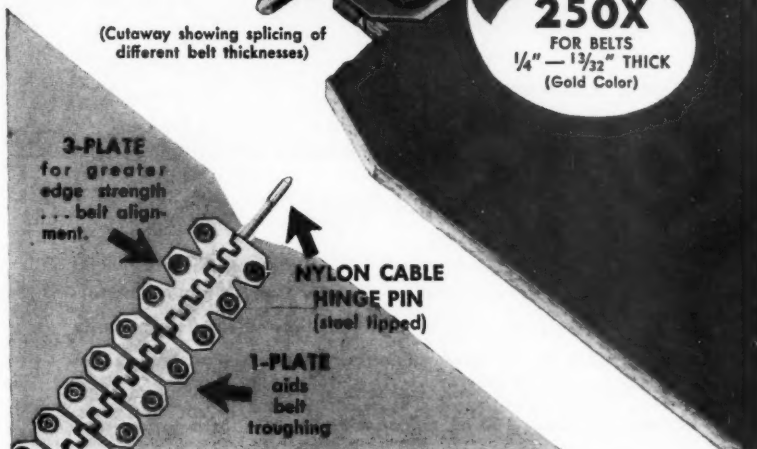
500X

FOR BELTS
3/8" — 1/2" THICK
(Silver Color)

250X

FOR BELTS
1/4" — 3/32" THICK
(Gold Color)

(Cutaway showing splicing of different belt thicknesses)



CUT FASTENER APPLICATION TIME IN HALF BY USING THE NEW . . .

- FLEXCO SPEED TOOLS with an impact wrench.
- FAR-PUL BELT CLAMPS—the easiest, quickest way to pull belt ends together.
- ALLIGATOR WIDE BELT CUTTERS—assures straight cut.
- EASY "CLIP" METHOD — newly designed clips hold fasteners in correct position while nuts are being run down — no other alignment tool required (clips included with every carton joint).

HANDY PACKAGING



Complete splices of 500X and 250X fasteners for any given width of belt available in cartons (carton includes pins, bolts, nuts and clips).

ORDER FROM YOUR DISTRIBUTOR, or write for bulletin 500X.

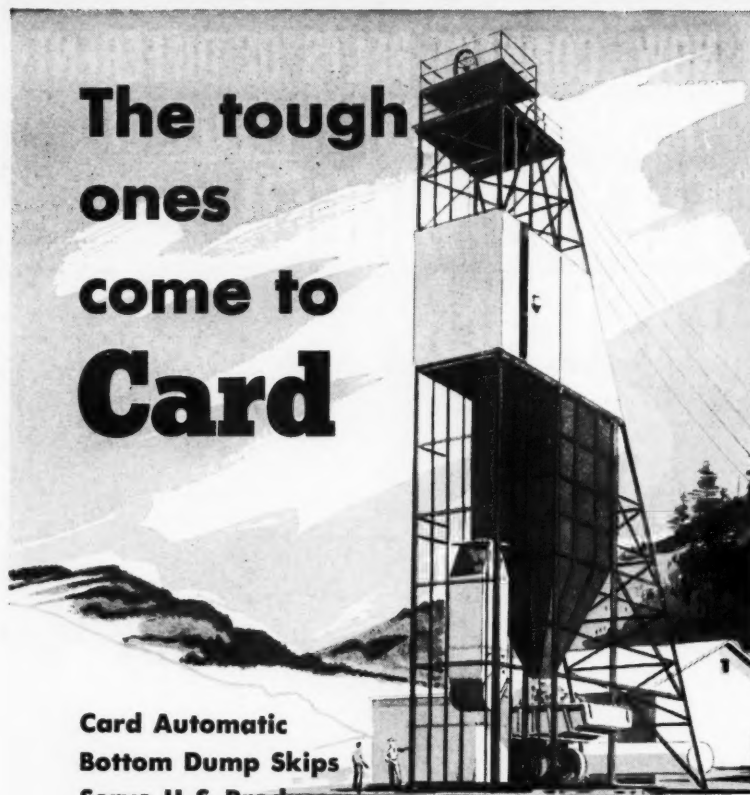
Flexible **STEEL LACING COMPANY**

4675 LEXINGTON STREET

CHICAGO 44, ILLINOIS

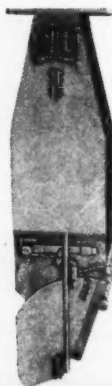
109

The tough ones come to Card



**Card Automatic
Bottom Dump Skips
Serve U. S. Producers
in most Major Mining Areas**

This is a progress report on a relatively new idea. Beginning in 1956, increasing demand for the new Card automatic bottom dump skips has gradually brought them into service in a majority of the nation's principal mining areas—from Arizona to the Canadian line. In a typical operation two of these Card skips of approximately 150 cu. ft. capacity each are used to haul ore up a thousand-foot three-compartment shaft at a rate in excess of 900 tons per day.



In the initial year of operation, in one such installation, these automatic skips carried over 270,000 tons of rock before needing attention other than routine maintenance. The same successful design will prove out in your next project. It can be adapted to any capacity and specifications with ease.

Tell us your requirements.

C.S. Card Iron Works Co.

2501 WEST 16th AVE.
DENVER, COLORADO

A joint venture to extract anhydrous magnesium chlorides and oxides from the Great Salt Lake in Utah has been proposed by interests identified as Hogle Brothers, Bonneville-on-the-Hill, Rico Argentine Mining Co., Kearns Tribune Co. and James G. Macey, Salt Lake City geological engineer. The group has executed a lease—royalty agreement with Utah State Land Board under terms of which \$750,000 must be spent during the next two years toward construction of a pilot plant to test an extraction process developed by Macey.

A 300 kw electron beam furnace, said to be the largest ever built, has been installed at the Richmond, Calif., plant of Stauffer Metals Division of Stauffer Chemical Co. for the commercial production of refractory metals. The new furnace increases rated capacity of electron beam furnaces in the U. S. for producing refined refractory metals to about 200 tons per year. In contrast to vacuum arc melting, the electron beam furnace process does not require a high grade feed and can treat mill scrap, fines, metal powder and sinter.

Columbia-Geneva Steel Division of U. S. Steel Corp. has dedicated its new \$1,500,000 research laboratory located at Provo, Utah. The research center will study western iron ores, coal, coke, and various mineral beneficiation processes with the object of improving blast furnace practices.

Sidney Mining Co. plans to continue exploratory drifting at Beardsley Gulch in the Bayhorse district near Clayton, Idaho. The company has for the past several months been exploring for a lead-silver ore body of commercial value. Contemplated work calls for making some shipments of ore mined by raising in the best showings which may lead to a commercial ore body. Expenditures of about \$20,000 are anticipated.

American Chrome Co. will install an 8½-ft diam pelletizing disc in its Nye, Mont., ferrochrome plant. The disc will be used to prepare a flux-chromite concentrate mixture for introduction into a submerged arc furnace which will convert the pellets into ferrochrome.

A 500-tpd uranium processing mill is to be built by Petrotomics, Inc., in the Shirley Basin of Wyoming. The mill is slated to be in operation by March 1962.

J. R. Simplot Co. will move its ammonium phosphate plant, which is located at Anaconda, Mont., and was purchased last year from the Anaconda Co., to its fertilizer products plant at Pocatello, Idaho. Anaconda had been operating the Montana facilities for Simplot since the acquisition. Simplot is also replacing its phosphoric acid plant at Pocatello with a new one having additional triple superphosphate capacity, which will permit abandonment of the phosphoric acid and triple superphosphate plants at Anaconda.

The 1960 annual report of Phelps Dodge Corp. reveals that the company is installing a new process for removing oxygen from copper in the anode furnaces at its Morenci and Ajo, Ariz., smelters. The new process uses reformed natural gas instead of wood poles. The report also discloses that testing of two processes for the recovery of small quantities of oxide copper from sulphide ores are being conducted at the Morenci concentrator, and that a small commercial plant for the manufacture of sponge iron from iron oxides produced in the smelting process is being built at the Douglas smelter. The sponge iron will be used as a precipitant for copper in leaching operations.

In Alaska, United States Smelting Refining and Mining Co. expects to begin the coming season with eight dredges operating. Two of the dredges will operate only part of the season and then will be shut down. The company started the 1957 season with 11 dredges operating.

Development work at the San Mateo mine of Rare Metals Corp. of America near Grants, N.M., has been placed on an around-the-clock basis and the company now anticipates having the mine operating at about 400-tpd by mid-year. The upper portion of the mine's 1100-ft vertical shaft collapsed in March 1960 as the mine development program was nearing completion. The shaft was subsequently repaired, but water damage in the main haulageway of the mine necessitated driving a new haulage level, which by mid-October permitted initial production of development ore. Elsewhere, the company expects to continue exploration this summer on thorium properties in Idaho and zinc properties in Washington, that are being examined under long-term option agreements.

Seattle Convention Plans Moving Ahead

Chairmen of Arrangement Committees Appointed

Preparations for the 1961 AMC Metal Mining and Industrial Minerals Convention, September 11-14, are rapidly taking shape, following the appointment of key committee chairmen by Robert M. Hardy, Jr., chairman of the AMC Western Division and president of Sunshine Mining Co. Serving as co-chairman of the General Committee with Mr. Hardy is S. M. Strohecker, Jr., Seattle manager for E. I. du Pont de Nemours & Co.

Chairman of the Welcoming Committee is M. H. Freedman, who is district vice president of sales for Columbia-Geneva Steel Division, U. S. Steel Corp. Wylie M. Hemphill, president of Pacific Silica Co., will serve as chairman of the Trips Committee, and Emmett G. Eastery, district sales manager of Atlas Powder Co., will head up the Trips Committee. The chairman of the Publicity Committee will be announced shortly.

On the Ladies' Hospitality Committee, Mrs. Dorothy M. Hardy of Yakima, Wash., is honorary chairman and Mrs. Robert M. Hardy, Jr. of Spokane, Wash., is chairman.

To insure a successful convention, enthusiastic mining men and women in the Pacific Northwest have accepted appointments to serve on the various committees. They will see that "the welcome mat is out," and will be ready to show the Nation's miners a thoroughly enjoyable time in Seattle next September.

Appointments of State and district chairmen of the Program Committee, under the National chairmanship of Joseph C. Kieffer, manager of the Northwestern Mining Department, American Smelting & Refining Co., are moving ahead on schedule. This group, representing both metal and industrial mineral producers from every section of the

United States, will get together in June to develop a top-notch program containing vital information for everyone in the mining industry. Suggestions for subjects and speakers are now being compiled, and Journal readers are urged to forward their suggestions to the American Mining Congress without delay so that they can be included in the committee's agenda.

This year's convention takes on special significance because of the many complex economic and technical problems facing the industry today that were nonexistent a few years ago. The convention sessions will focus on the major problems and provide every mining man an unexcelled opportunity to avail himself of the concentrated knowledge of experts from all segments of the industry.

There will be operating sessions on open pit and underground mining, geology and exploration, and minerals beneficiation as well as such important topics as safety and management techniques. General sessions will deal with matters of Government and industry policy. In all of these, leading authorities will present up to date information that will help the industry overcome its problems.

The importance of being on hand at Seattle September 11-14 can hardly be overstressed. Heavy past attendance at AMC Conventions speaks their success, and this year will be no exception. For every forward-looking mining man, the Seattle Convention is a "must."

Make your plans now. All reservations for accommodations are being handled by the Housing Bureau operated by the Seattle Convention and Tourist Bureau, 215 Columbia Street, Seattle 4, Wash. Processing of requests for accommodations will begin next month and first assignments will be sent out early in July.

A beryllium concentrator will be built in the Topaz Mountain area of Utah, according to plans of Beryllium Resources Corp. Construction will begin after it is determined how much ore upgrading is required to make a suitable concentrate for metallic reduction in a 19-step refining process.

Bagdad Copper Corp. has completed work on a \$2,000,000 leaching plant at its Bagdad, Ariz., operations. The new plant will permit recovery of copper values as cement copper from low-grade oxide ores which the company has been stockpiling for about 15 years. Production from the leaching operation is expected to be about 20 tons of copper per day.

United Gold Mines Co. plans to reopen the Theresa mine at Cripple Creek, Colo. The mine has been closed for 20 years.

The Republic of the Philippines is inviting bids for development and operation of the Zambales Mineral (Chromite) Reservations consisting of three land parcels totalling about 6600 acres in the province

of Zambales. United States citizens and companies that are 60 percent owned and controlled by U. S. citizens may submit bids by the July 12, 1961 closing date. Interested parties should contact the Chairman, Committee on Award, Bureau of Mines, Manila, Philippines for further information or copies of the invitation.

Hanna Mining Co. is making plans, subject to the outcome of negotiations with the Government, to acquire the U.S. owned nickel smelter at Riddle, Ore. Hanna has operated the plant since 1955, smelting ore from its nearby mine for the account of the defense materials stockpile. Acquisition of the smelter would permit the company to enter the ferro-nickel field as the only domestic producer of this strategic material.

U. S. Beryllium Corp. has purchased 14 beryllium claims near its Boomer mine in Park County, Colo., from Denver-Golden Corp. U. S. Beryllium, which now controls about two sq mi of claims in the Badger Flats area of Park County, is the largest producer of beryllium minerals in this country. Low grade ores from the

Boomer are treated by the Mincon process to extract beryllium oxide, a ceramic material having the capacity to withstand the high temperatures experienced in missile and space vehicle applications. Beryl assaying in excess of eight percent BeO is sold to the Government.

Kaiser Engineers is designing and constructing facilities for beneficiation of limestone at Permanente, Calif., for Permanente Cement Co. Differential grinding and froth flotation will be used to provide sufficient limestone to sustain production of 6,750,000 bbl per year of cement.

A 1200-ft diamond drill hole is being put down by Sunshine Mining Co. at the property of Sunshine Consolidated, Inc., which adjoins the Sunshine mine, famed silver producer in Idaho's Coeur d'Alene Mining District. The hole, now past the 500-ft point, will test formations that carry mineable ore at deeper horizons, but have not heretofore been tested on the 1200 level.

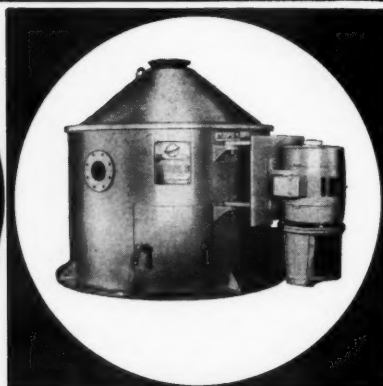
Stockholders of Goldfield Consolidated Mining Co. and Getchell Mine, Inc., will be asked to vote on a proposed merger of the two companies. Goldfield acquired control of Getchell in August 1960.

Exploratory drilling near Bellevue, Idaho, is reported to have revealed the presence of the Minnie Moore vein, which had a production record of about \$9,000,000. Silver Star Queens Mines, Inc., made the discovery while diamond drilling below the 450-ft level of the Rockwell shaft. A system of post-mineral faults interrupts the Minnie Moore at depth.

Kennecott Copper Corp. is enlarging and improving the precipitation system by which copper is recovered from waste material on the mine dumps at the Chino Mines Division in New Mexico. In 1960, this operation produced about 19,000 tons of copper which was 20 percent more than in 1959.

Duval Sulphur & Potash Co. is continuing evaluation of a porphyry copper deposit near Kingman, Ariz., which has been under investigation since 1959. Fifty-two drill holes completed at the property at the end of 1960 developed a substantial area of copper molybdenum enrichment. Additional drilling and evaluation are contemplated this year.

THE C.M.I. COMPACT 26



NEWEST ADDITION TO THE CMI LINE OF CONTINUOUS CENTRIFUGAL DRYERS

The all new CMI Compact 26 is the first compact dryer for moderate requirements; the first compact dryer specifically made for a capacity of 20 tons per hour or less of coal or minerals; the first compact at a modest price.

Send for Bulletin 26 which contains complete information.

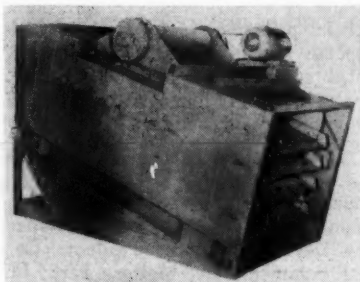
CMI

CENTRIFUGAL & MECHANICAL INDUSTRIES, INC.

146 PRESIDENT STREET • ST. LOUIS 18, MISSOURI

manufacturers forum

FULLY-ENCLOSED MODELS OF VIBRATING SCREENS have been announced by Deister Machine Co., 1933 East Wayne St., Ft. Wayne 4, Ind. Designed for use where ore and coal create troublesome dust problems, enclosures can be furnished on

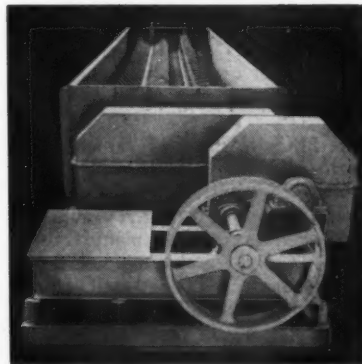
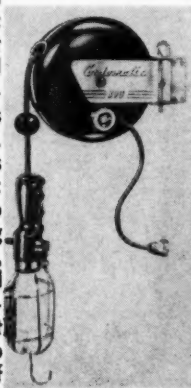


any screen in the Deister line, although they provide protection against dust, the enclosures also afford ready accessibility to all working parts of the screen. Enclosure panels are fabricated of heavy-gauge steel and are held securely in place by swing bolts. They can reportedly be quickly removed which makes for convenience in adjusting screen tension and changing screening medium. Hinged top panels are equally easy to open.

A PORTABLE CHAIN AND FLIGHT-type coal elevating conveyor with a surge hopper is a development of the Nolan Co., Bowers-ton, Ohio. It is designed to receive coal from the mother belt conveyor for discharge into the automatic mine car loading chute at a uniform rate. A special feature is the installation of the mother belt on a horizontal plane instead of the usual incline normally required in conventional designs to reach the top of the loading chute. This eliminates the necessity for removing an excess amount of roof to accommodate an inclined belt conveyor. The standard Nolan Loadveyor Model C-200 has a capacity of 500 tph, with a surge bin capacity of two tons. Higher capacity units will be available. The chain and flights are standard shuttle car parts. The unit is driven by a 25-hp motor for either a-c or d-c operation.

A CRAWLER MOUNTED ROCK DRILL WITH REMOTE CONTROLS has been introduced by Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa. Designated the TDM-B1, the machine is of flexible swinging boom design, permitting hydraulic positioning of the feed and drill to put down holes in a lateral arc 45° from center. This means the drill can be positioned over the side of the crawlers for line drilling in confined areas. Full-range power positioning permits changing from vertical to horizontal drilling without manual adjustment of the feed. Drilling controls are mounted on an arm that swings with the boom, yet may be adjusted to vary the distance between the drill and the operator. The operator can swing in close to the drill to start a hole, then swing back, away from the drill to get away from the rock dust being blown from the hole. For more information on the TDM-B1, which carries the Joy 450-DR Dual Rotation Drill as standard equipment, write for bulletin NR-2W.

A DROPLIGHT REEL, Model 800, manufactured by Cordomatic, 17th and Indiana Ave., Philadelphia 32, Pa., reportedly eliminates dangerously kinked and knotted electric cords; when not in use, the cord automatically retracts into its reel housing. Other features pointed out are: a gravity stop action locking mechanism, which locks and releases with finger-tip control at any length up to 30 ft; dust-proof and life-time lubricated heavy-duty spring motor; and a phenolic shatter-proof handle with built-in convenient outlet for secondary power source for such hand tools as drill, sanders, etc. The complete unit is UL approved.



A LARGER SIZE LOG WASHER has been developed by McLanahan Corporation (formerly the McLanahan and Stone Corp.), Hollidaysburg, Pa., to provide increased capacities for processing phosphate, but is also recommended for gravel, crushed stone, manganese and iron ores. The new Mudmaster Log Washer has 12-in. logs; it was formerly available with only ten-in. logs. A greater paddle arc, resulting in a reportedly greater cleaning action and larger output, has been made possible from the increased log size. Main components of the washer are: heavy gauge, steel plate washer box with adjustable slope; square logs and paddles; patented hydraulic gudgeon; cut tooth, spur gear drive train.

A FUEL CELL DEMONSTRATION KIT that produces electricity from chemical reactions and is designed primarily as a teaching aid for secondary schools is now available from Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. The kit was developed in response to requests from many science teachers and students. It employs a basic fuel cell principle. Fuel used is alcohol and the oxidant is hydrogen peroxide, with the electrolyte being potassium or sodium hydroxide. Catalysts are platinum for the fuel and silver for the oxidant. Chemicals added to the cell are usually standard supplies in a high school chemistry laboratory. The kit will sell for \$9.75 postpaid, and will produce electricity sufficient to operate a 1½-volt motor for about 15 min. on one fueling.

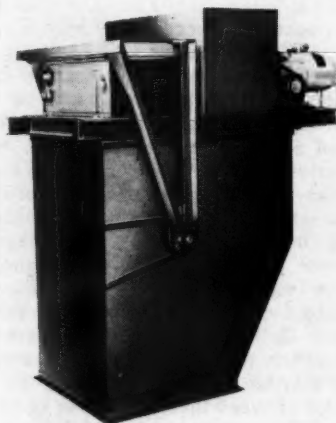
ALL-ALUMINUM FRAMES of high strength for dumping trailers, tankers and flatbed trailers have been introduced by Ravens-Metal Products, Inc. 1300 Market St., Parkersburg, W. Va. Designated the Series BX Frame, this unit is adaptable for carrying any legal highway capacity and can be modified for use with heavy off-highway trailers. Said to be 50 percent lighter in weight than equivalent steel frames, they are standard equipment on Ravens trailers. These frames are also available for use with bodies of other trailer manufacturers.

A FIRE RESISTANT HYDRAULIC featured on the latest design Style CMC Red Bit from Vascoloy-Ramet Corp., 800 Market St., Waukegan, Ill. According to the manufacturer, bit, lug and retainer pin life are greatly increased due to the bit's perfect fit in quick change block. The collar is said to bear equally on all sides; thus, the bit seats solidly with no wobble for uniform wear on the lug. It is also claimed that bit changes are quicker and easier, because the collar keeps fines from packing in the lug. The bit has a cylindrical carbide tip brazed into a cylindrical pocket.

A FIRE RESISTANT HYDRAULIC FLUID called Gulf FR Fluid is now being marketed by Gulf Oil Corp. An emulsification of 40 percent water in oil gives the new product its resistance to fire. Each droplet of water is coated with oil, providing lubrication reportedly equivalent to all-oil fluids.

In the event of fire, the water droplets turn to steam and snuff it out. The new fluid's fire resistance has been confirmed by U. S. Bureau of Mines tests.

A NET WEIGHING SCALE for rock dust batching, with a capacity of 40 tph of rock dust at an accuracy of 0.1 percent, has been developed by Thayer Scale Corp., Thayer Park,



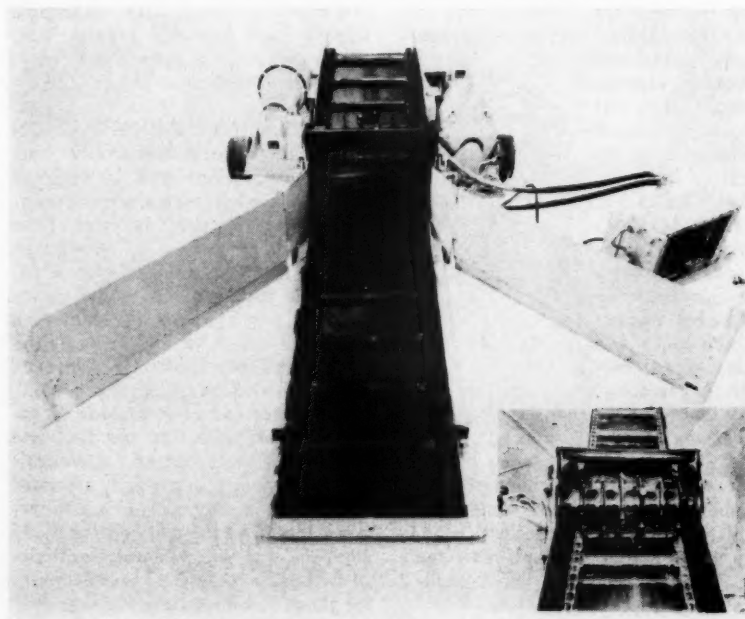
Pembroke, Mass. The B18R unit consists of a special rotary feeder and a Thayer Flexure-Plate scale which supports a tipping weigh bucket. The patented flexure plate eliminates knife edge pivots and other friction surfaces which would be subject to wear. Both manual and automatic operation of the dump cycle is permitted by a selector switch on the control box. Expected to have wide-

spread application in mineral industries or any activity requiring large scale, rapid weighing of fine, dry aggregates and dusts, the equipment is said to be unaffected by abrasive dust, dirt, moisture, shock, or temperature changes.

CHAIN DRIVES developed for transmitting power of small gas turbine engines—30 to 1800 hp—have been announced by Morse Chain Co., Ithaca, N. Y. The chains are applicable to main or auxiliary drives and are readily capable of transmitting rotating power between parallel shafts at high speed. Known as the Hy-Vo (high velocity—involute sprocket) the chain is a refinement of the silent chain principle for extremely high speeds and heavy loads. It incorporates compensating links that eliminate chordal action encountered at very high chain speeds.

A HEAVY DUTY AIR HOSE for quarries, mines and heavy construction applications has been developed by Dayton Industrial Products Co., 2001 Janice Ave., Melrose Park, Ill. Marketed under the name, Maximair, the new hose has double braided high tensile rayon construction. An abrasion resistant Neoprene cover provides protection and reportedly assures long wearing qualities even under rugged conditions. The hose can maintain pressures up to 400 psi in certain sizes, and is available in 25, 50, and up to 75 ft lengths through two in. sizes.

A FEEDER-BREAKER, called "Rosco" by its manufacturer, Long-Airdox Co., Box 331, Oak Hill, W. Va., is designed to facilitate the handling of excessively large lumps of material on belt conveyors. The machine consists of two separate elements: (1) a feeder-type chain conveyor, normally with a 40-in. trough width, and (2) a rotary breaker. The "Rosco" feeder-breaker is driven by two motors, one each for the conveyor element and breaking element, with both motors controlled by a single combination starter. The combined unit is designed to limit the lump size feeding on the belt conveyor, eliminate spillage at the tail section, and load the belt evenly without surge loading. The feeder-breaker is applicable to all shuttle car mining systems regardless of seam height. It reportedly reduces the size of lump material to the recommended maximums of 10-12 in. for a 30-in. belt, and 12-14 in. for a 36-in. belt.



—ANNOUNCEMENTS—

Atlas Copco, Inc., has named **Howard C. Sheperd** as chairman of the board and **Peter Redpath** as president. Additional appointments included **C. E. Burton** as executive vice president and **R. G. Chambers** as vice president of the Eastern division. Atlas Copco, Inc., was formed at the beginning of 1961 by merging Atlas Copco Eastern of Paramus, N. J., and Atlas Copco Pacific of San Carlos, Calif.

Josef H. Buerger, Jr., and **Robert M. Simpson** have been appointed to new positions in **Crucible Steel Co. of America**. Buerger, who was formerly assistant to the vice president-commercial, becomes director of sales, and Simpson, formerly assistant general manager-field sales, becomes assistant director of sales. Before joining Crucible in 1960, Buerger had been vice president of marketing for Yuba Consolidated Industries. Simpson has been with the company since 1940.

Robert V. Gunther was recently named executive vice president and general manager of **Southwestern Engineering Co.** of Los Angeles. He has been with Southwestern Engineering since 1942, and had previously been president and general manager of the engineering and construction division.

Robert J. McGinnis, a coal mining industry veteran of 57 years, retired recently after 16 years with **Kennametal, Inc.**, Latrobe, Pa. McGinnis played a pioneering role in coal mine mechanization by application of tungsten carbide tools. He was known as "Mr. Kennametal" to mining men wherever he went in his role as a roving salesman and trouble shooter. He had been with Kennametal since 1945 when its Mining Tool Division was set up and prior to that was with Butler Consolidated Coal Co. In retirement he will remain active as president and treasurer of McGinnis Bros. Bit Service, Inc.

James C. Sheehan has been named by **Mine Safety Appliances Co.**, Pittsburgh, as product line manager in which position he will coordinate development and sales of the firm's line of gas masks for a wide variety of applications. He has been associated with the company for 11 years as a sales engineer in the Tennessee-Kentucky area of the Atlanta District.

Harold W. Buus has been appointed general manager of **Stearns Magnetic Products Division of Indiana General Corp.**, Milwaukee, succeeding **Frank S. Greenwald** who has been named manager of Product Development of the parent corporation. Named as director of engineering to assume responsibility for research and development and production engineering is **William G. Luedtke**, currently chief engineer.

Robert W. Hanna, Jr., has become manager of **Link-Belt Company's** Pittsburgh district office and warehouse, succeeding **Otto W. Werner**, district manager for the past 15 years, who has been transferred to engineering contract sales. Hanna has served Link-Belt since 1941 when he joined them in the Philadelphia district. Werner joined the company in 1923 and has been at Pittsburgh since 1935.

Edward W. Sacoff, a veteran of 25 years with **Link-Belt Co.**, has been named as manager of the company's district sales office at Moline, Ill. He was district sales engineer in Chicago before his present appointment.

Kenneth W. Nelson, a nine year veteran in **Thor Power Tool Co.**, has been named regional sales manager for mining and contracting tools in the company's Zone 4 territory, which extends from the Carolinas through the New England states. Nelson has been a sales and service engineer in the Chicago area since 1952.

Howard M. Dorward, manager of Wire Rope Sales for the Rocky Mountain Division, **The Colorado Fuel and Iron Corp.**, since 1948, has been appointed product sales engineer of the Wire Rope Sales Department of the Western Division. Dorward has been with CF&I since 1946.

Scientific and Process Instruments Division of **Beckman Instruments, Inc.**, has opened a new sales office in St. Louis at 3545 Lindell Blvd. to which **Edward J. Klein** and **Jack Weit** have been appointed as sales engineers. Klein will be responsible for laboratory instrument and Weit for process instrument sales.

Bill Allison, formerly field engineer in the Salt Lake City district for **Hewitt-Robins, Inc.**, has become district manager, succeeding **James E. Van Stone**, who was promoted and transferred to Cleveland, where he will be manager.

CATALOGS & BULLETINS

POWER CONTROL PANELS. *General Electric Co., Schenectady 5, N. Y.* Detailed application data of grouped power control panels which utilize standard components arranged to customer's specific requirements are given in Bulletin GET-3041, "Cabinetrol Power Centers." Included are complete specifications on squirrel cage, synchronous-motor, wound-rotor-motor and d-c motor combination starters, as well as incoming line breakers, secondary breakers and feeder circuit breakers. The bulletin also details overload relay heater specifications, provides guide form specifications for electrical equipment and diagrams the Cabinetrol dimensions.

WELDING ALLOY WALL CHART. *All-State Welding Alloys Co., Inc., 249-255 Ferris Ave., White Plains, N. Y.* Chart is designed to aid rapid selection of welding, brazing, and soldering alloys and fluxes according to the base metal to be joined. Included is a description of the company's aluminum joining alloy line.

PRE-ENGINEERED METAL BUILDING LINE. *Buildings Division, Parkersburg Rig & Reel Co., Parkersburg, W. Va.* Catalog No. BD-660 describes the company's complete line of permanent, pre-engineered metal buildings. All types are reportedly delivered ready to assemble with factory-fitted parts, without the necessity of cutting, welding, or punching in the field.

CRAWLER CRANE-EXCAVATORS. *Koehring Division of Koehring Co., 3026 W. Concordia Ave., Milwaukee 16, Wis.* Ten on-the-job photographs and appropriate descriptive copy are used to illustrate the performance of two of Koehring's crawler crane-excavators, the ¾-yd 305 and the 1-yd 405 in a brochure entitled, "Make More Dollars Move." Hoe, shovel, clam, dragline, and crane front ends are illustrated.

MINE CAR LOADER. *Gardner-Denver Co., Quincy, Ill.* Gardner-Denver has introduced a new and more powerful mine car loader called the GD18. According to the manufacturer, extensive field tests under severe production mining conditions have proven the high efficiency, reliability and ruggedness of this machine. For more information, write for Bulletin MCL-3.

FRACTIONAL HORSEPOWER MOTOR. *Reliance Electric & Engineering Co., Cleveland 17, Ohio.* A description of the construction and design details of the Duty Master fractional horsepower motor is given in Bulletin B-2514. Each point is illustrated with photos and drawings, and life size photo of a cut-away motor is shown in full color. Major characteristics and advantages reported for this motor are in the area of improved ventilation, reduced weight, and increased protection.

SHEAVE BLOCKS. *Alloy Steel & Metals Co., Box 58323 Vernon Station, Los Angeles 58, Calif.* The automatic centering "F" series of Pacific quick-opening sheave blocks are featured in Bulletin No. 305. It describes the complete line of Pacific sheave blocks, including full plate sheave blocks, wide throat carrying blocks, tail block assemblies, and Pacific sheave anchors.

(Continued on next page)

(Continued from previous page)

BORING EQUIPMENT. *Kwik-Mix Co., Ka-Mo Tools Dept., Port Washington, Wis.* The complete line of Ka-Mo earth and rock boring power transmission units, auger sections, and accessories are illustrated and described in a 12-page brochure listing each model in the line along with condensed specifications for that model. Also included is a description of the many types of cutting heads available.

PORTABLE CABLES FOR SURFACE MINING. *Anaconda Wire and Cable Co., 25 Broadway, Dept. EFL-P, New York 4, N. Y.* A technical paper, Anaconda Publication No. C-118 covers the development and application of portable cables for surface mining and reviews cable requirements, maintenance fundamentals, and the repair of damaged cable. The information is particularly applicable to the use of electric power shovels in open pit mines.

RECORDING FLUOROMETER. *G. K. Turner Associates, 2524 Pulgas Ave., Palo Alto, Calif.* The Turner Model 111 Self-Balancing Fluorometer is described in a new data sheet. The equipment provides both direct readout and outputs for various types of recorders or controllers. Literature describes the optical-bridge design, the automated operation, and the sensitivity of 0.02 ppb quinine sulfate, which make the Model 111 useful in the fields of trace analysis, clarity determinations, air and water tagging, and other fluorescence measurements.

MOTOR INSULATION. *Louis Allis Co., Dept. P, 427 E. Stewart St., Milwaukee 1, Wis.* A "Capsular" insulation system for encapsulated random wound a-c induction motors is discussed in Bulletin No. 3750. These motors reportedly offer added protection against moisture, chemicals, oils and abrasive contaminants, providing longer life for open motors used in adverse environmental atmospheres. The Capsular insulation system can be supplied on open, drip-proof motors, 445U frame sizes and smaller—600 volts, and below, including special electrical and mechanical features.

MOTORIZED WHEEL. *General Electric Co., Schenectady 5, N. Y.* The motorized wheel drive developed for off-the-highway equipment is described in Bulletin GED-4261. It contains photographs of a working earth-hauling vehicle using the equipment, and also offers a haulage study for potential users.

DRYERS, COOLERS, HEATERS. *Hardinge Co., Inc., York, Pa.* Including new material on fundamentals of drying, selection of proper drying equipment and drying economics. Catalog No. 16-E fully describes the Ruggles-Coles direct and indirect type dryers, water and air-cooled rotary coolers, and other Ruggles-Coles rotary equipment.

CENTRIFUGAL PUMPS. *Goulds Pumps, Inc., 219 Black Brook Road, Seneca Falls, N. Y.* The Model 3405 line of single stage, double suction centrifugal pumps now includes 34 sizes, providing capacities from 100 to 6400 gpm with heads up to

525 ft. Bulletin No. 721.6 features complete specifications, interchangeability chart, performance curves and dimensions of these pumps.

ANSWERS TO HAULING PROBLEMS. *Athey Products Corp., 5631 W. 65th St., Chicago 38, Ill.* Entitled "Athey Forged-Traks," the booklet offers practical answers to unique hauling problems, particularly for jobs that cannot be handled by conventional wheeled vehicles, and tells how high-flotation Traks provide hauling capability in many functions throughout many industries.

SINGLE ROLL CRUSHERS. *Pennsylvania Crusher Division, Bath Iron Works Corp., West Chester, Pa.* Covering in detail the operation of the Atlas single-roll crusher, Bulletin No. 2025 is the first formal information available for this new equipment for primary crushing of soft gypsum, shale, slate, coal, fire clay, soft limestone, chemicals, and phosphate rock. The bulletin also includes construction specifications of the crushers along with capacity tables and detailed dimensions.

FIRE FIGHTING EQUIPMENT. *The Fyr-Fyter Co., 221 Crane St., Dayton 1, Ohio.* Form No. S-62FPB covers the company's lines of 'portable' type interior fire safety equipment. Engineering and specification data is included for fire extinguishers, fire hose and extinguisher wall cabinets; hose racks, hose reels, angle valves, fire hose, fire hose nozzles, Siamese connections, and related fire control accessory equipment.

Index to Advertisers

Allis-Chalmers, Inside Front Cover

American Air Surveys, 104

American Brattice Cloth Corp., 104

American Cyanamid, 8-9

American Mine Door Co., 11

Anaconda Wire & Cable Co., 103

Atkinson & Co., Guy F., 17
(Trinity Dam Contractors)

Bethlehem Steel Co., 89

Bowditch Co., 25

Card Iron Works, C. S., 110

Centrifugal & Mechanical Industries, Inc., 112

Chicago Pneumatic Tool Co., 28

Deister Concentrator Co., 88

DuPont de Nemours, E. I. & Co., 83

Euclid Division, 18
General Motors Corp.

Farrell-Cheek Steel Co., 11

Fletcher & Co., J. H., 2

Flexible Steel Lacing Co., 109

Gardner-Denver Co., 6-7

General Cable Corp., 16

General Electric, 92
Locomotive & Car Equipment Dept.

Gerow, Theron C., 104

Goodman Mfg. Co., 14-15

Great Lakes Steel, 30-31
Div. of National Steel Corp.

Gundlach Machine Co., T. J., 71
Div. of J.M.J. Industries, Inc.

Hardinge Co., Inc., 82

Hewitt-Robins, 96

Hercules Powder Co., 10

Ingersoll-Rand Company, 27

Jeffrey Mfg. Co., 44-45

LeBus International Engineers, 102

Lee-Norse Co., 22-23

LeTourneau-Westinghouse Co., 12-13

Longyear Co., E. J., 109

Macwhyr Wire Rope Co., 26

Mine Safety Appliances Co., Back Cover

Mining Progress, Inc., 49

Mott Core Drilling Co., 104

National Iron Co., 4

National Mine Service Co., 29

Nordberg Mfg. Co., Inside Back Cover

Ohio Brass Co., 101

Olin-Mathieson, Ltd., 17

Pattin Mfg. Co., 106

Sanford-Day Iron Works, 95

Sheffield Steel Div., 24
Armco Steel Corp.

Texas Gulf Sulphur Co., 32

Timken Roller Bearing Co., 99

U. S. Rubber Company, 20-21

Vascoloy-Ramet Corp., 19

Victaulic Co. of America, 107

Wild-Heerbrugg Instruments, Inc., 105

Woomer & Associates, 104



स्वर्ण

GOLD...soft, ornamental—hard master of man

In ancient times when gold was written स्वर्ण in Sanskrit, it was used for ornaments. However, it soon became a mark of status and wealth, and the search for gold changed the face of the world. New lands were discovered and populated with the word of gold discoveries.

The most common gold ores of that era were low grade, hard and abrasive igneous, sedimentary and metamorphic materials. Recovery of the gold was practical only because of the availability of slaves and conquered labor.

Mining gold ores today is a matter of high recovery at lowest possible cost. Exceptionally well-suited for this work are Symons® Cone Crushers. As a result, wherever gold is mined, as in all other important ore and mineral operations throughout the world, Symons Cone Crushers are first choice of major producers.

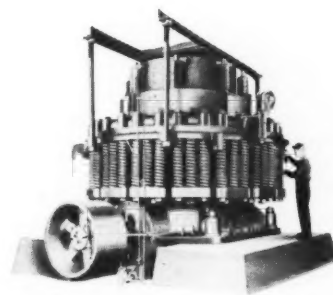
NORDBERG MANUFACTURING COMPANY • Milwaukee 1, Wisconsin

NORDBERG

©1961, N. M. CO.

C261

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS
SAN FRANCISCO • TAMPA • WASHINGTON • WICHITA, KAN. • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.



SYMONS® CONE CRUSHERS
... The machines that revolutionized crushing practice ... are built in a wide range of sizes, for capacities to over 1500 tons per hour. Write for descriptive literature.



SYMONS ... a registered Nordberg trademark known throughout the world.

NEW Completely Transistorized M-S-A® Model E-60 MinePhone®

Here's the first mine communications system fully protected against power failure

Power failures can't knock out the rugged M-S-A E-60 MinePhone.

Always operative, power comes from the storage battery, on constant charge from the trolley. Takes only *one watt* of battery energy to ready the MinePhone for standby transmission or reception. In event of power failure, you still have hours of service from the fully charged battery. As power is restored, battery is automatically recharged.

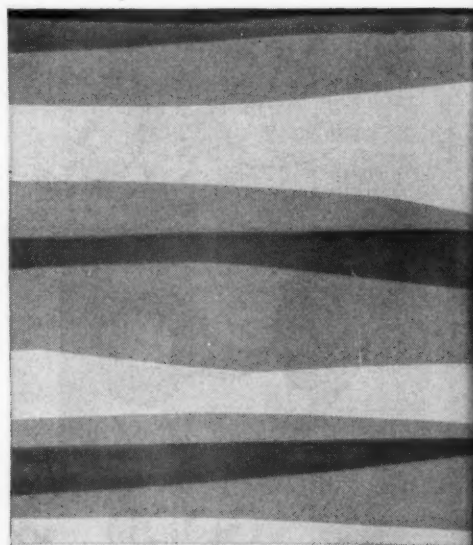
The compact transistor makes possible a 35% reduction in size of this new transmitter/receiver. There are no vacuum tubes to wear out. No damage due to vibrations.

Consider these safety factors: the E-60 MinePhone —

needing no warm-up period — permits instant reporting of hazardous mine conditions. Scheduling is more efficient. And in case of emergency you can alert both surface and mine personnel — keep them tuned in — even when trolley power is off.

You can realize an impressive pick-up of movements from face to tippie, too. More trips per shift without costly traffic tie-ups. Improved control and distribution of mobile equipment. No unnecessary starting and stopping.

Your MSA representative would be pleased to discuss your actual communication requirements. Call him soon. And write us for free product data bulletin. Mine Safety Appliances Company, Pittsburgh 8, Pa. In Canada: Mine Safety Appliances Co. of Canada, Ltd., 500 MacPherson Ave., Toronto 4, Ontario. **MSA**



f
.d
y
s
y
e
s
n.
y
e

